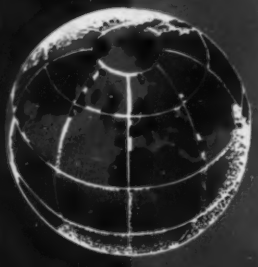
SEPTEMBER 1957 VOL 19 NO 10

MINING WORLD



American Zinc Bores A 66-inch Shaft Page 60

Hydraulic Jet Stoping Of Gilsonite Page 68

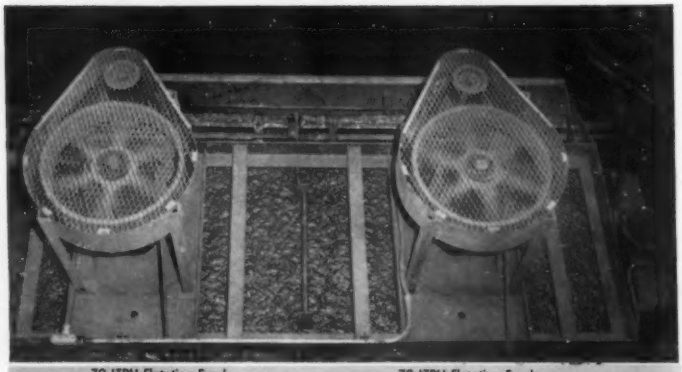
Inspiration: Dual Process Yields More Copper

Page 50

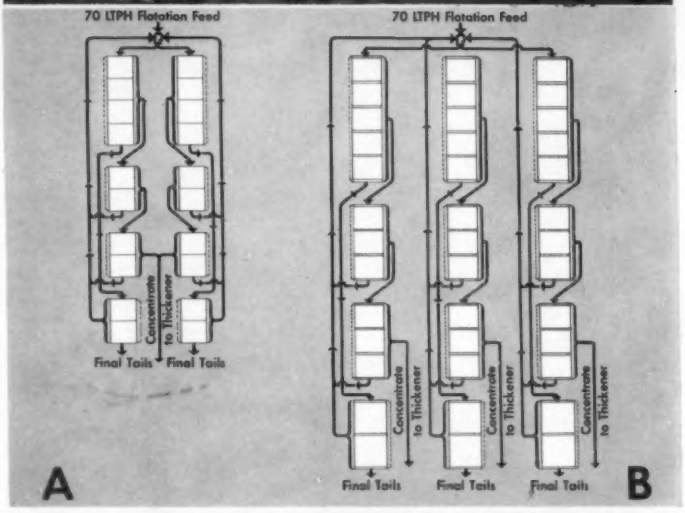
50 cents a copy—3s 6d in sterling

WEMCO

Fagergren Flotation 8 ways better!



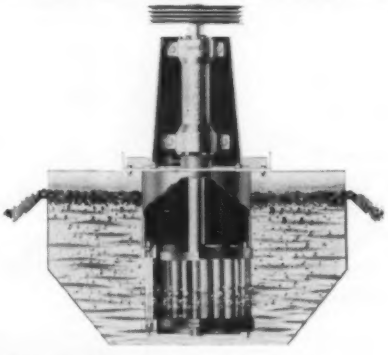
here's the proof: In an efficient new iron flotation concentrator, two parallel flotation circuits are used. Each receives identical feed, and each handles 70 long tons per hour with grade meeting market requirements. Check and compare these facts:



		Wemco Fagergren Units A	Other Flotation Units B
Circuit Characteristics	✓ Number of Cells	20	39
	✓ Gross Cell Volume[1]	1220 cu. ft.	2400 cu. ft.
	✓ Floor space (all cells)	644 sq. ft.	988 sq. ft.
	✓ Launder & Operating aisles (approx.)	167 sq. ft.	261 sq. ft.
	✓ Total Launder Length (approx.)[2]	225 ft.	375 ft.
Typical Metallurgical Results on This Type of Iron	✓ Units of Iron Recovered	1%-2% more	
	✓ Tailings Loss	1%-2% less	
	✓ Reagent Consumption	.2-.3 lbs. less per ton treated	

Notes: 1 – Taggart, Section 12 page 80, shows WEMCO-Fagergren efficiency of cell volume substantially greater than others, in addition to the above noted advantage in space alone.

2 – Shorter launder length in WEMCO circuit allows steeper slope; requires less wash water, causing less dilution of concentrate and minimizing dewatering requirements.



A reprint of the complete story is available for the asking. Write to:

WEMCO

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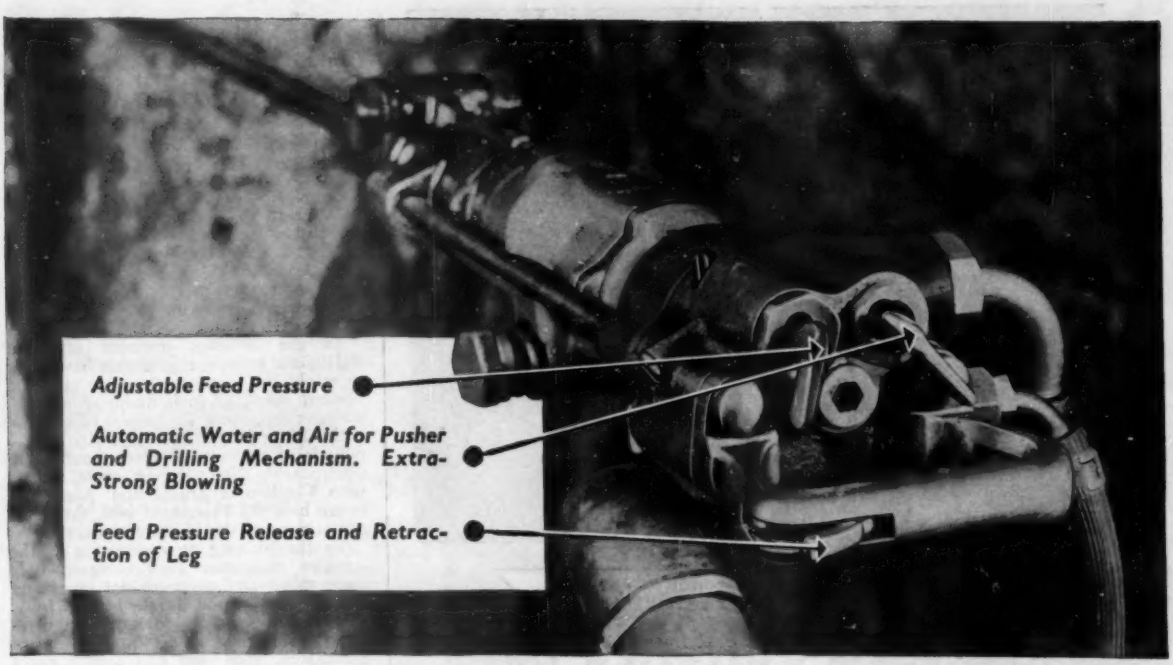
SAN FRANCISCO 7, CALIFORNIA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Feed Pressure Release and Retraction of Leg

THE ATLAS COPCO LION – A REVOLUTIONARY NEW ROCK DRILL

All controls under one hand

The Atlas Copco Lion is the first drill to have all the valves which operate the drill under the control of one hand. *Full and easy control without having to move the hand from the backhead!* All the controls have been designed so that they are well protected. While using them the operator's hand is never near the wall or roof of the drift. The Lion is the first pusher leg drill with controls placed for drifting.

Retractable leg saves time

When the leg has to be moved the feed pressure is easily released by squeezing the hand grip. By further pressure on the grip the leg retracts automatically. When the leg is in the new position suitable for continuous drilling, retraction stops and the feed pressure comes back by loosening the grip of the hand. *All this can be done while the drill is still running.*

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Packed with power for deep holes

The Lion has a drilling rate at least 30% higher than other rock drills of the same weight. Furthermore, it can maintain its high speed *even when drilling deep holes*. This means quickly drilled deep hole rounds and a faster advance. The Lion also reduces *to a minimum* the gauge wear of the bits in abrasive rock. And owing to the ease with which the feed pressure is released and brought back into action, the Lion is a *handier* drill to work with in fissured rock.

Sandvik Coromant—the steel for the Lion

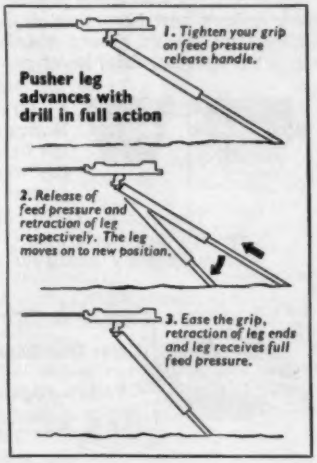
All Atlas Copco drills—and this goes for the Lion too—have been developed from the earliest stages with Sandvik Coromant tungsten-carbide-tipped integral steels and detachable bits. This combination pioneered tungsten carbide drilling in the early forties. No drill or steel developed separately could ever give such equivalently high performances as this drilling combination. Today it is the most widely used in the world, responsible for drilling more than 1,000 million feet annually.

For further information on the Atlas Copco Lion rock drill, and details of sales and service, please contact:

U.S.—Atlas Copco Pacific, Inc., 930 Brittan Avenue, San Carlos, California, or Atlas Copco Eastern Inc., P.O. Box 2568, Paterson 25, N.J.

CANADA—Atlas Copco Canada Limited, Montreal Airport, P.Q.

MEXICO—Atlas Copco Mexicana S.A., Apartado Postal 56, Torreon, Coahuila.


1. Tighten your grip on feed pressure release handle.
Pusher leg advances with drill in full action
2. Release of feed pressure and retraction of leg respectively. The leg moves on to new position.
3. Ease the grip, retraction of leg ends and leg receives full feed pressure.

Atlas Copco

D1574A

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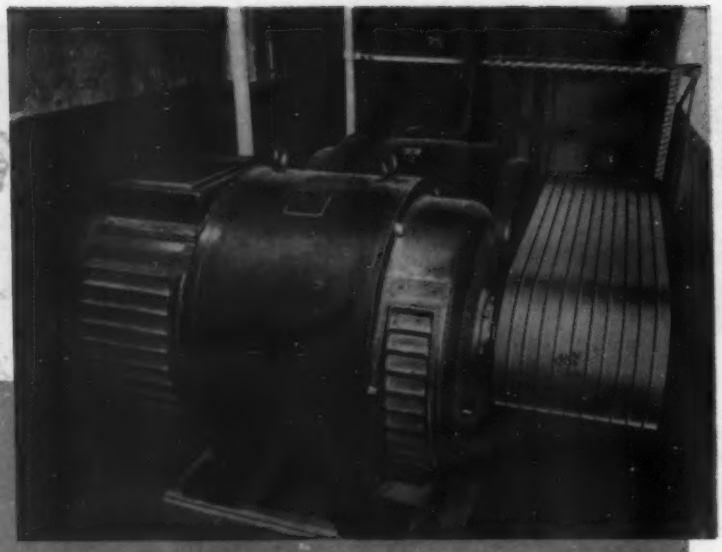

How CONCAVE SIDES cut V-belt costs

By this simple test you can see for yourself how the concave sides (Fig. 1) of the Gates V-Belt lengthen the life of the belt... *thus reducing costs.*

Just bend a Gates V-Belt and feel the sides. You will see that these precisely engineered concave sides have now *become straight*, permitting them to grip the sheave groove evenly. (Fig. 1-A). This assures longer belt life; lower costs.

THE CONCAVE SIDE
U.S. PAT. NO. 1813498

Now make the same test with a straight-sided belt. (Fig. 2) Notice how the sides bulge out on the bend (Fig. 2-A) concentrating the wear at the points shown at arrows.

These tests should convince you that it *pays* to specify the V-Belt with Concave sides—Gates Vulco Rope...readily available from nearby distributors.

TPA 199

Gates Distributors are in the Yellow Pages

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Denver, Colorado

There are Gates Engineering Offices and Distributor Stocks in all industrial centers of the U. S. and Canada, and in 70 other countries throughout the world.

Gates VULCO ROPE Drives

GRAB SAMPLES From the Mail

Why Won't Our Holes Detonate?

Dear Sir:

We read with much interest the article in MINING WORLD (December 1956, page 54) by A. E. Millar, general manager for The Anaconda Company, dealing with the use of fertilizer grade ammonium nitrate for blasting in the copper mine at Weed Heights, Nevada.

In the asbestos open-pit mine at Balangero, Italy, our engineers have tried to apply the same process by charging vertical holes, 2¾-inch diameter and 10 meters deep, using 4.5 pounds of gelatine with 83 percent nitroglycerine, 17.5 pounds of agricultural grade ammonium nitrate with 20.5 percent azote, mixed with ¼ gallon of Diesel fuel. Along the entire hole the Primacord with the Pentrite connected the blasting charges.

By the blasting no disjunction of the asbestos serpentine rock occurred—only some splits—and we were not even sure that the ammonium nitrate blasted fully. Tests have been repeated employing carefully mixed ammonium nitrate instead of granulated. This blast had a poor effect also.

We then changed the grade of ammonium nitrate, using technical grade with 35 percent azote instead of the fertilizer grade. We got no better results.

We feel that more particular advice is necessary concerning the use of ammonium nitrate for blasting. We will be glad, therefore, if you will be so kind as to help us contact Mr. Millar, who no doubt will be in a position to furnish us with all details concerning efficient blasting.

AMIANTIFERA DI BALANGERO S. p. A.
Milan, Italy

MINING WORLD is pleased to print the following letter of advice on blasting ammonium nitrate loaded holes. This letter contains additional details of Anaconda's experience which will be useful to all open pit miners. It also reports that, again, Anaconda has successfully cut Weed Heights' blasting cost by decreasing the weight of the more sensitive and decidedly higher priced primer.—ED.

Gentlemen:

As the article outlined, we are using ammonium nitrate as a blasting agent in large diameter holes. Our ordinary blast hole is drilled with a 7⅞-inch rotary drill bit. We have blasted a few holes drilled with a 6-inch rotary drill bit and have found that these holes, when loaded with ammonium nitrate, Diesel fuel, and a primer, detonated satisfactorily. We have had no experience whatsoever in attempting to blast holes smaller than 6 inches in diameter with ammonium nitrate as a blasting agent.

Our blasting practice is still essentially the same as the practice outlined in the article in the December 1956 issue of MINING WORLD. We have been able, however, to reduce the amount of primer used in our blast holes. At the time the article for MINING WORLD was written, we were using 25 pounds of special gela-

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VOLUME 19 **SEPTEMBER 1957** NO. 10

OPERATIONS—TECHNOLOGY

Milling & Hydrometallurgy

Inspiration's New Dual Process 50

By Stanley H. Dayton

Faced with mining lower grade copper ore containing increasing amounts of sulphides, Inspiration revives the Dual Process, using flotation to scavenge sulphides from acid-leached ore. The new treatment method adds capacity and flexibility to Inspiration's operations.

Rehabilitated Mill Treats Acid Leached Tailing 55

By Stanley H. Dayton

$6,000,000 mill modernization program was most fundamental aspect of Inspiration's project for activating the Dual Process. The concentrator contains provision for complete isolation of a 2,500-ton-daily test circuit from the remainder of the mill.

New Facts on Cinnabar Flotation 65

By Keith Kunze

Three Nevada-Oregon mills have successfully used flotation to recover cinnabar. Test work leading to development of mercury flotation methods at these mills indicate standard textbook treatises of this subject have contained questionable data.

Mining

American Zinc Bores 66-inch Ventilation Shaft 60

How American Zinc revived the Calyx shot boring technique to drill a large diameter ventilation shaft for its "Dieselized" Young mine.

Underground Jet Mining of Gilsonite 68

American Gilsonite Company pioneers and perfects the world's first hydraulic jet stoping method to recover Gilsonite for production of gasoline. Particularly outstanding is pipeline transport of ore from Bonanza, Utah to Gilsonite, Colorado, a distance of 70 miles.

Convention

Salt Lake City Welcomes the AMC 72

By J. M. Taylor

Miners follow the path of early day Mormons as Salt Lake City is host to the 1957 American Mining Congress Convention.

IN THE NEWS

Central Eastern 91
Northwest 97
Southwest 103
Rocky Mountain 109
International 115

DEPARTMENTS

Drifts and Crosscuts 5
Mining World Newsletter 7
Capitol Concentrates 9
Fission Facts 13
International Panorama 49
U. S. Personalities 75
International Newsmakers 77
Production Equipment Preview ... 80
Metal and Mineral Prices 126
Money Making Methods 67
Advertiser's Index 132

ON THE COVER

To dispose of flotation tailing from its recently rehabilitated 15,000-ton-per-day mill, Inspiration Consolidated Copper Company adopted a modified version of the method used at Morenci. Shown in the picture is an 18-inch Transite pipe which serves as a manifold for discharge outlets spaced on 26-foot centers.

READERSHIP RESEARCH

MILLER FREEMAN PUBLICATIONS

Grabs

tin, 60 percent, in conjunction with 175 pounds of ammonium nitrate fertilizer grade for each blast hole. At the present time we are using 12½ pounds of special gelatin, 60 percent, and 180 pounds of ammonium nitrate for each hole. We have also used and are still using in some of our blast holes, a primer of five pounds of duPont Nitramite in conjunction with 180 pounds of ammonium nitrate fertilizer grade. We find that either of the above mentioned primers will successfully and completely detonate the ammonium nitrate after one gallon of Diesel fuel has been added to each 80 pounds. In all cases the primer is connected with Primacord which is detonated by an electric blasting cap.

The ammonium nitrate that we use in our blasting is an ordinary prilled fertilizer grade ammonium nitrate that is commonly available in this area. The chemical analysis of this ammonium nitrate shows a total nitrogen content of 33.5 percent which is made up of 16.75 percent ammonic nitrogen and 16.75 percent nitric nitrogen. The prilled ammonium nitrate that we use contains some three to five percent diatomaceous earth.

As explained in the December Mining World article, we have had unqualified success in detonating ammonium nitrate in our blast holes at Weed Heights and know of no reason why others should encounter difficulty in using ammonium nitrate, Diesel fuel, and a primer for blasting holes of 6 to 8 inches in diameter.

If you have any questions concerning ammonium nitrate blasting, we would be glad to answer them upon receipt of your inquiry. In this event, please give us complete details as to your blasting procedure and what difficulties you may have encountered and we will then try to analyze your problems. There is one particular point which you should bear in mind and that is: as you decrease the diameter of your blast holes you must increase the amount of primer explosive used in order to sensitize the ammonium nitrate.

H. R. Burch
Assistant General Manager
The Anaconda Company
Weed Heights, Nevada

Cleveland-Cliffs Iron Company was a pioneer in the use of ammonium nitrate blasting on the Mesabi Iron Range. At the company's Hawkins mine Nashwauk, Minnesota about 6.0 percent of fuel oil, by weight, has given best results when added to the nitrate.

The company has carried out successful experiments in water filled holes by packaging the blasting agent in water proof containers and adding enough high gravity material to sink the containers to the bottom of the hole. Pulverized ferrosilicon homogenously mixed with the prilled nitrate and fuel oil gave good results—the ferrosilicon, of course, being heavy enough to sink the charge. However, high cost of ferrosilicon was an adverse factor. Experimentation has been successful in reducing the amount of ferrosilicon if the mixture is vibrated in a can to secure a higher bulk density. Patents have been applied for to protect these recent developments. . . . Ed.

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Drifts and Crosscuts

MINING WORLD Will Attend Three Meetings

September will be a busy month for miners and metallurgists in all parts of the world. Three important meetings will be held in the United States, Canada, and Sweden. MINING WORLD will have a regular staff member at each of these meetings to learn latest developments and report significant methods and equipment uses to you.

The first meeting will be the Sixth Commonwealth Mining and Metallurgical Congress starting in Vancouver, British Columbia on September 8th and continuing across Canada for a full month of field trips, meetings, and mine tours. George O. Argall, Jr., editor, will attend the initial sessions in Vancouver. Canada has gone all out to assure a most successful meeting for delegates from more than 34 countries.

The second meeting will be the Western Division of the American Mining Congress in Salt Lake City, Utah starting September 9th. This annual meeting is held in a western city every year and always draws a large crowd. Salt Lake has again made plans for a learn-and-fun meeting with details outlined elsewhere in this issue. Stanley Dayton, associate editor, and Henry Grundstedt, manager of engineering services, will be there to meet you.

The International Mineral Dressing Congress in Stockholm, Sweden from September 19 through 22nd will attract a record number of metallurgical engineers from the United States. Several of these engineers will present important papers. Following the meeting, inspection tours will be made to important mines and metallurgical plants in Sweden, Norway, and Finland. Max F. Holsinger, general manager of MINING WORLD, now making his headquarters in Europe, will attend this meeting as your representative.

Large mill hammers taken from the scrap pile needed a 2" to 2¼" build-up on length... required approximately 5 lbs. of Manganese and Stoody 100, combined. Smaller amounts of build-up and hard metal are required for subsequent maintenance.

DON'T THROW AWAY 9/10 OF EVERY MILL HAMMER

The Victorville Lime Rock Company on the Mojave Desert some 75 miles from Los Angeles operates a plant for the reduction of high grade limestone that is processed for a great many uses, from face powder base to roofing materials. For intermediate crushing the company uses a hammer mill and maintenance is, of course, the usual problem.

When a Stoody representative first called at this plant he found a scrap pile of worn hammers that had been discarded in favor of standard replacements. 9/10 of the hammer was still there but so severely worn as to have lost its efficiency. A set of nine new hammers represents an investment of approximately $200.00, so the huge scrap pile, to the hard-facing specialist, had all the appearance of a gold mine.

Tests were undertaken to determine the cost of rebuilding such hammers; a copper form was clamped around the worn end to fix the shape and the finish length. Using the semi-automatic welder running Stoody Nickel Manganese, the hammer was brought back to just under finish size, then peened and hard-faced on the end and corners with Stoody 100.

The original experimental rebuilding job proved successful and the procedure outlined has now been established as routine. New hammers measuring 4"x5"x10½" weigh 45 pounds. Between four and five pounds of Manganese and Stoody 100, a high-alloy, wear-resistant material, are required to bring a worn hammer back to size. The semi-automatic welding procedure is extremely fast, depositing three to six times as much weld metal as is possible by the manual method. After rebuilding, each hammer is carefully weighed and balanced for proper operation of the mill. As wear occurs in service, the semi-automatic welder is used to apply additional Stoody 100 free hand to maintain hammer size and shape.

By the method described hammer costs are enormously reduced and the mill's performance is considerably improved.

Further information on the hard-facing of all types of crushing equipment is provided by various pieces of Stoody literature. See your Stoody dealer (you will find him in the "Yellow Pages" of your phone book) or write direct.

George Stone, Maintenance Superintendent, shows turn-table fixture which speeds welding. Forms surrounding hammers are copper, establish hammer size and height of build-up.

Other hard-facing includes these quarry shovel teeth. Points are rebuilt with Stoody Manganese and hard-faced with Stoody 100. Note the copper mold which shapes the point.

STOODY COMPANY

11969 East Slauson Avenue

Whittier, California

MINING WORLD NEWSLETTER

SEPTEMBER 1957

The Golden Anniversary of beneficiation in Minnesota was observed last month. 50 years ago the mining industry foresaw the time when the future of Minnesota iron mining would depend upon development and beneficiation of low-grade ores. Today, 78 plants are in operation, providing jobs for 19,000 miners in the state.

More money will be spent in additional recovery equipment as the quality of Iron Range ores will decrease.

High standards set by steel manufacturers, coupled with world-wide competition, spark continual research and development of up-grading processes for iron ore. Future of the Iron Range depends upon continuing technological advancements.

Many new trends in mining have made recent headlines.

Hydraulic mining of gilsonite has been developed by American Gilsonite Company. It is the only mining firm in the world to pump all of its ore to the surface in a column of water.

Movement of ore through a long high-pressure pipe line is another "first" for American Gilsonite. It has not been done on a commercial scale before.

Large-hole drilling is being revived for sinking ventilation shafts. American Zinc Company of Tennessee is using the Calyx process to drill a 66-inch-diameter round hole. This is only the fourth time in history for this type of application.

Low-cost blasting methods using ammonium nitrate fertilizer compounds are being steadily improved. MINING WORLD carried first reports on this new practice. Chemical manufacturers are finding more and more that the mining field is a good outlet for their products.

Lead-zinc legislation still has not been passed at this writing.

Great united effort has gone into getting some relief for the base metal producers. Industry, labor, and even the State Department, spoke in its favor and urged immediate action by Congress during hearings before the House Ways and Means Committee.

Partial relief may be obtained through use of the escape clause of the Tariff Act if the bill doesn't pass this session of Congress, say many congressmen.

The Office of Defense Mobilization is empowered, under an amendment to the escape clause provision, to investigate where an industry of strategic importance is being injured through excessive imports. If such is the case, then the President can set quotas and even establish embargoes under the amendment. In 1954, the Tariff Commission recommended an increase in import duties, but the President decided to establish an accelerated stockpiling program instead.

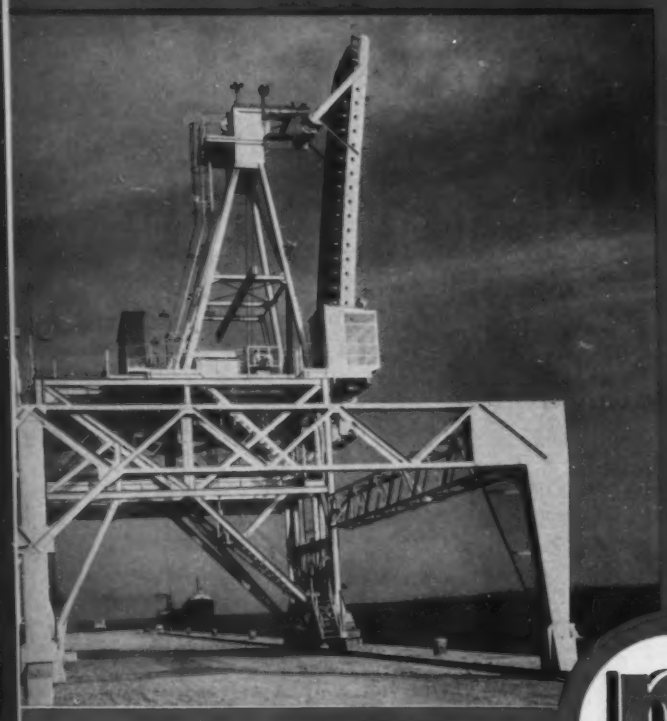
A potentially great copper mining district is steadily developing around the Tucson, Arizona area.

A 60,000,000-ton-plus ore body has been disclosed by American Smelting and Refining Company in its Papago Indian Reservation property. This is the largest drilled out in the area to date.

Other large operations in the district include Duval Sulphur and Potash Company's 49,000,000-ton property and Pima Mining Company's multi-million-ton mine, both open-pit producers, and Banner Mining Company with three underground mines.

The huge ASARCO open pit at Silver Bell completes the Tucson district to the northwest.

from MINE to MILL through FINISHED PRODUCT



McDowell shiploader at Presque Isle, Michigan stone plant

Dwight-Lloyd® sintering plant at Benson Mines, N.Y.

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Capitol Concentrates

Minerals Program Can't Please Everyone; But Passage Is Essential Says Seaton

The domestic mining industry must be kept healthy and vigorous for the best interest of the United States said Secretary of the Interior, Fred A. Seaton, as he dedicated the new gasoline-coke from Gilsonite refinery of American Gilsonite Company in early August. The Secretary said, "The lead and zinc industry requires assistance if it is to avoid serious injury as the result of a high level of imports.

"Production of beryl, columbium-tantalum, and chromite—so essential to our national security—requires Federal encouragement if explorations and development are to be possible; and if, in the long run, these industries are to become competitive with those abroad. The Administration believes the Federal government must now take new steps to provide such assistance and encouragement.

"There are several reasons for putting the Administration's Long Range Program into effect. It will enable the government to provide special assistance to the lead and zinc industry, which is threatened by a high level of imports. It will also enable the government to give special encouragement through production bonuses to producers of beryl, columbium-tantalum, and chromite. These minerals are in short supply here and abroad. They must be transported great distances. They stand some chance of becoming competitive with foreign industries. And they are essential to our national defense.

"It is true that a Long Range Minerals Program cannot be expected to please everybody. In fact, I should be concerned if the extremists were satisfied. Some people have already said that the Administration wants to go too far in strengthening domestic mining industries and in participating in development, research and exploration work. Others have said that the program doesn't assist the industries enough."

• Phosphate Leasing Bill Awaits House Action

The House Interior Committee has given its approval to the Senate-passed bill designed to spur development of phosphate deposits on public domain lands. The bill now awaits House consideration.

The measure, S. 334, would eliminate the present 5,120-acre limitation on phosphate leases which may be held by any one company on the public domain within any one state, while retaining the present 10,240-acre limitation on such holdings throughout the United States by one company. A similar bill was passed by the Senate last year, but failed to receive House action due to the rush of business at the end of the session.

• Peril Point Figures Need Adjustment

The copper people pinned their faith on a bill with a "peril point" of 24 cents. As this is written the London price for copper is 26.75 cents per pound, or dangerously near the peril point below which a totally inadequate tariff of 2 cents per pound would apply. The Emergency Lead-Zinc Committe has made the same mistake of setting exact peril points in its proposed bill (17 cents for lead, 14.5 cents for zinc). Due to the rising costs of operation, no law which states an exact figure without provisions for escalation can be termed long-range as some day the industries affected will have to go to Congress for increased peril points. Copper now can justify at least a 32-cent peril point and should have a 4-cent tariff as well, rather than the 2 cents now applicable.

It is difficult to understand why the people who master-minded these bills did not tie their peril points to the nonferrous index of the Bureau of Labor Statistics so that the peril points would vary with costs. If the copper industry had done so its peril point now would be at least 32 cents and it would not be facing the headache of going to the Congress for an amendment to the present act.

• Better Luck Next Year!

At this writing it appears that Congress may go home without passing any legislation which will be of substantial aid to domestic mining. Next year, being a political year, the West may have more luck!!

• Additional Hurdles For Lead-Zinc Tariffs

Both the Interior and State Departments have stated (but only when under pressure) that if the lead-zinc import tax bill passed tomorrow it could not go into effect earlier than January 1, 1958. Also, the State Department testified before the House Ways and Means Committee that it will have to negotiate substantial concessions with countries which export zinc and, if such negotiations are not successful, these countries under the Trade Treaties Act can retaliate as they please in order to balance their losses.

• Minerals Program Has Shortcomings

There is general agreement within the mining industry over one point about the Seaton "Long

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Range" Minerals Program; i. e., it is in no way long range. Furthermore, while the lead-zinc industry likes the import tax (just another word for tariff) proposal, it feels that the bill as written by the Administration will do little or no good. According to testimony before the Senate Finance Committee, the tax schedules need upward adjustment, and some means should be provided to escalate the "peril points." Otherwise, it is stated, the bill will soon be as out of date as is the present copper tariff bill which has a peril point of 24 cents which now should be at least 30 cents. No program is long range if the industry has to keep going back to the Congress for adjustments.

One question is being asked frequently: "As the President already has ample authority to make the tariff adjustments, why does he put the job up to the Congress?" The probable answer is that the State Department, although endorsing S. 2375 under pressure, hopes that the Congress will fumble and lose the ball.

As for the rest of the Seaton program, the Administration could continue Defense Minerals Exploration on its own terms without Congressional approval. No one is satisfied with the terms set forth in S. 2375, especially the pauper's-oath section. Concerning the incentive payments section, witnesses testified that the bill is calculated to put the mines out of business as the proposed payments are grossly inadequate, not enough minerals are included, and the per-mine tonnage allotments are so small as to preclude efficient operations.

The Congress is between the devil and the deep blue sea. If it enacts Seaton's program as presented, it does no one any good; if it drastically amends the program, it risks a veto. Things do not look too good at this point.

• Return To Gold Standard Is Opposed

Treasury Secretary Humphrey, shortly before his resignation became effective, stated without reservation that he would oppose putting United States currency on the full gold standard until "world conditions some day are stabilized."

The secretary's statement was made before the Senate Finance Committee, during an investigation of the Administration's fiscal policies, in answer to questions raised by Senator George Malone of Nevada. Malone had proposed going back to the gold standard as a way of stabilizing the currency and coping with inflation.

Senator Malone also asked questions about the amount of United States gold which foreign holders could demand from the Treasury. Secretary Humphrey replied that, theoretically, foreign central banks and international institutions could demand that the Treasury sell the $9,100,000,000 of its $22,700,000,000 gold holdings for dollars. He added, however, that only a world upheaval could force such a run on United States gold and in that case the Treasury probably would declare a moratorium to halt such sales. The United States is still required to keep gold on hand to cover 25 percent of the amount of federal reserve notes and deposits, now estimated at close to $47,000,000,000.

• Mine Inspection Is State Job, Says Goldwater

Senator Barry Goldwater of Arizona has urged Congress to bring to an end federal inspection of coal mines, and thus restore to the states powers and functions which are their rights and responsibilities. His recommendation came in a speech reviewing the 10-year history of the first and second Hoover Commissions and demanding less concentration of power in the federal government.

Senator Goldwater cited the mine-inspection program as an example of the growth of federal government at the expense of the state saying:

"In 1946, as a result of certain mine disasters, Congress was pressured to have the federal government take over the job of (coal) mine inspection. Here is a function that is state and local by any criteria. Mining states are relatively few. The place of work and inspection—the mines—is highly localized. The local community knows intimately the conditions and safety requirements of operations. State and local laws and police powers operate directly upon mining employers and employes. Enforcement can be directly supported by the people most concerned with mine operations—the mine workers, the mine unions, and the local population. Why should the federal government in distant Washington be concerned with this job? Every circumstance makes mine inspection a state and local function, and the right of the states and local communities to do the job should be restored to them."

Goldwater's position on the mine-inspection program is in direct opposition to the proposals now before Congress calling for an extension of the federal government's activities in this field to metal and nonmetallic mines.

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COMING CONVENTIONS

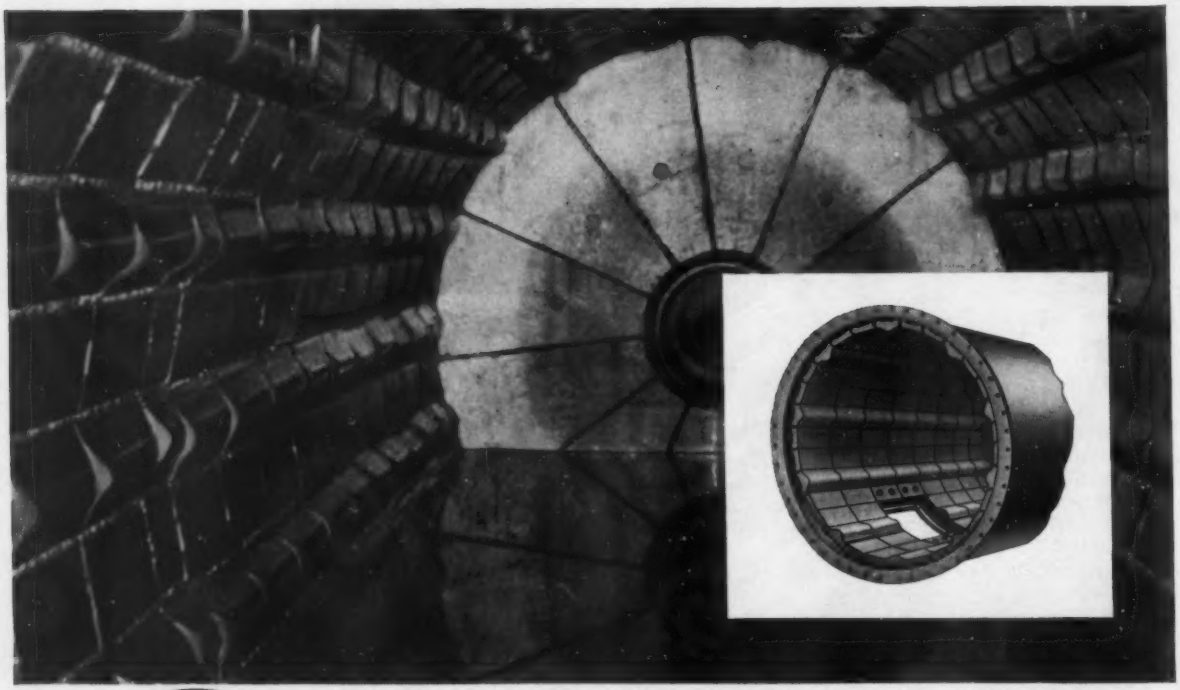
October 3, 4, and 5. Seventh annual EXPLORATION DRILLING SYMPOSIUM of the University of Minnesota. At the Center for Continuation Study, Minneapolis, Minnesota.

October 15 through 18. SOUTHEASTERN STATES MINING CONFERENCE and the ANNUAL MEETING OF THE SOCIETY OF MINING ENGINEERS, Hillsboro and Tampa Terrace Hotels, Tampa, Florida.

October 21 through 25. The 45th annual NATIONAL SAFETY CONGRESS AND EXPOSITION, Conrad Hilton Hotel, Chicago, Illinois.

October 30 and 31, November 1. Fourth annual ROCKY MOUNTAIN MINERALS CONFERENCE, sponsored by the AIME. Cosmopolitan Hotel, Denver, Colorado.

November 2 through 8. Second WORLD METALLURGICAL CONGRESS, Chicago, Illinois.



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6. Reduced Costs in Liner Inventory—standardization is possible because one design fits all diameters of mills. Standardization means quicker unloading and storage.
7. Reduced Costs on Breakage Claims and Delays for Replacements—small castings are rugged and almost impossible to break by handling. Large castings of hard, brittle irons sometimes break in shipment.
8. Reduced Costs in Determining Most Efficient Wear Patterns—you can get wear profiles consisting of all lifter ribs or all flats from the same castings, as well as a combination of both including straight or spiralled lifter pattern.

Liners are supplied in two nominal thicknesses, 1½" and 3" with 1½" high lifters. Castings are 6" wide x 12" long. Positive seating of small castings on mill shell means less breakage of castings under operating conditions. For additional information on B&W Universal Tube Mill Liner Plates write The Babcock & Wilcox Company, Process Equipment, Barberton, Ohio.

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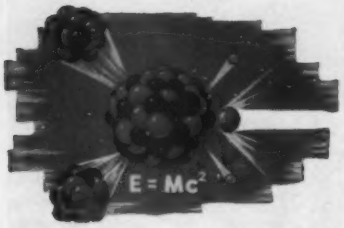


FISSION FACTS

Monthly Roundup of Mining News In the Atomic Energy Field

Pitchblende Deposits Will Be Investigated In Italy

Uranium ore occurrences in Italy, particularly in the Western Alps, are being closely studied with a view to ultimate mining, milling, and chemical processing. In the Piedmont region (Western Alps), underground exploration has disclosed several lenses of ore occurring as small, black lenses of pitchblende alternating with light-grey sericitic schists. The local thickness of the various ore lenses varies from 8 inches to 8 feet. The length of a single ore body varies between 150 to 300 feet. In this area outcrops of ore bodies are known over a distance of 1.5 miles.

In the Trentino region (Eastern Alps), the occurrence of uranium was discovered quite recently, and therefore exploration is still at a very early stage. At Val Daone (Daone Valley) in this region, mineralization will be studied underground, and this marks the first underground exploration in this area. Outcrops were detected on both sides of Val Daone. On one flank of the valley (which has been more accurately studied), the ore outcrop proved to be continuous over 550 yards and average thickness was between 12 and 18 feet. Pitchblende is found as thin layers coating quartz and pyrite grains. The ore-bearing formation is a sandstone of Permian age. Associated minerals in the deposit contain lead, titanium, copper, manganese, and vanadium, in addition to pyrite.

Colorado U_3O_8 Output Tops All Metals in 1956 Value

With the exception of petroleum, uranium topped every mineral commodity produced in Colorado in total value of production during 1956, according to the Colorado Bureau of Mines. Valued at $124,500,000, uranium output far exceeded the dollar value of the state's second-ranked mineral, molybdenum, which was valued at $44,237,000 last year. Oil and gas production in Colorado was valued at $166,867,778 in 1956. Total mineral production in Colorado last year, including oil and gas, was valued at $406,031,523; thus, uranium accounts for about one-third of the mineral income.

U_3O_8 Reserves Grow As Mill Capacity Tops 10,000 Tons

The capacity of uranium milling facilities in the United States is expected to nearly double by the end of 1958. A recapitulation of production shows that 14 uranium mills are now operating, and formal contracts have been signed with the Atomic Energy Commission covering concentrate purchases from eight other mills for which construction is definitely planned. Production of uranium oxide concentrates from 12 mills during the first half of 1957 totalled about 4,200 tons compared with 3,400 tons for the last half of 1956 and 2,600 tons for the first half of 1956. Output of concentrates for the final six months of 1957 will be augmented by yellow cake from Western Nuclear Corporation's new mill at Jeffrey City, Wyoming and Dawn Mining Company's plant at Ford, Washington. The latter operation went "on-stream" in August, while Western Nuclear started grinding ore near the end of June of this year. With the completion of these two operations total milling capacity is brought to 10,010 tons of ore per day. Later this year Texas-Zinc Minerals Company will complete a 775-ton mill.

The eight new plants under construction or planned will have a total capacity of 8,575 tons of ore per day. In addition negotiations for plant expansions at Western Nuclear Corporation (from 400 to 800 tons per day) and Rare Metals Corporation (from 250 to between 400 and 500 tons per day) are being carried on. Lucky Mc Uranium Corporation, now building a mill rated at 750 tons per day, is said to be negotiating for an additional increase in capacity which has been reported as ranging from 750 to 3,000 tons per day. A probable ninth new plant includes Phillips Petroleum Company in the Grants, New Mexico area, though no official announcement has been made as this is written.

Plants Operating as of Sept. 1, 1957

Company	*Location*	*Capacity Tons Per Day*
Union Carbide Nuclear Co.	Uravan, Colo.	1,100
Union Carbide Nuclear Co.	Rifle, Colo.	280
Vanadium Corp of Amer.	Durango, Colo.	430
Vanadium Corp of Amer.	Naturita, Colo.	350
The Anaconda Company	Bluewater, N. M.	3,000
Atomic Energy Commission	Monticello, Utah	600
Climax Uranium Company	Grand Junction, Colo.	350
Kerr McGee Oil Industries	Shiprock, N. M.	500
Mines Development, Inc.	Edgemont, S. Dak.	300
Rare Metals Corp.	Tuba City, Ariz.	250
Uranium Reduction Company	Moab, Utah	1,500
Vitro Uranium Company	Salt Lake City, Utah	550
Western Nuclear Corp.	Jeffrey City, Wyoming	400
Dawn Mining Company	Ford, Washington	400
	Total	10,010

Under Negotiation

Company	*Location*	*Capacity Tons Per Day*
Phillips Petroleum Company	Grants, N. M.	1,500

Plants Under Construction or Contracted

Company	*Location*	*Capacity Tons Per Day*
Gunnison Mining Company	Gunnison, Colo.	200
Lucky Mc Uranium Corp.	Fremont County, Wyo.	750
Union Carbide Nuclear Corp.	Maybell, Colo.	300
Texas Zinc Minerals Company	Mexican Hat, Utah	775
Union Carbide Nuclear Corp.	Rifle, Colo.	1,000
Homestake-New Mexico Partners	Grants, N. M.	750
Homestake-Sapine Partners	Grants, N. M.	1,500
Kermac Nuclear Fuels Corp.	Grants, N. M.	3,300
	Total	8,575

Possible Expansions

Company	*Location*	*Capacity Tons Per Day*
Western Nuclear Corp.	Split Rock, Wyo.	800
Rare Metals Corp.	Tuba City, Ariz.	400
Lucky Mc Uranium Corp.	Freemont, Wyoming	1,000

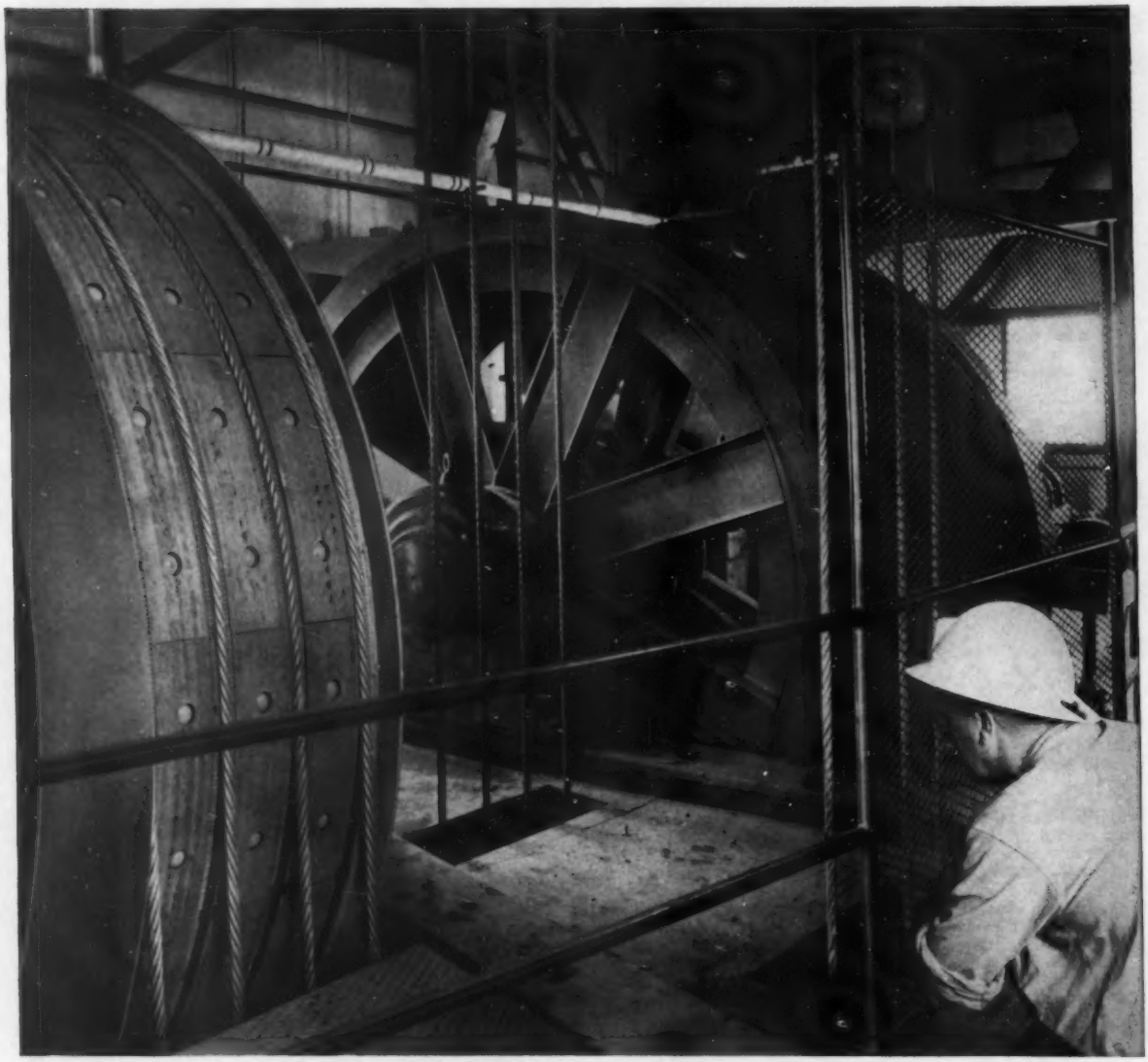
The above figures are designed capacity. However, it is well known that several mills have and are treating ore in excess of such capacity.

No significant new uranium producing areas were discovered in the past year, but reserves, as estimated by the Atomic Energy Commission, have increased about 12 percent over the figures given November 1, 1956. Intensive exploration in Wyoming by Phelps Dodge Corporation and others has more than doubled earlier reserve figures given for that state. New Mexico uranium ore reserves increased about 14 percent over the November 1956 total to 47,000,000 tons.

Area	Reserves on June 1, 1957	Increase or Decrease from Nov. 1956 Totals	Grade	Percent of Total Ore
New Mexico	47,000,000	+6,000,000	0.25	69.9
Utah	6,500,000	−1,000,000	0.36	9.7
Wyoming	5,600,000	+3,300,000	0.23	8.3
Colorado	3,700,000	− 400,000	0.32	5.5
Arizona	1,200,000	−1,400,000	0.27	1.8
Texas	1,100,000	a	0.23	1.6
Washington	940,000	− 360,000	0.18	1.4
N. Dak.–S. Dak.	600,000	a	0.25	0.9
Others	600,000	− 400,000	0.29	0.9
Total	67,240,000	+7,240,000	0.26	100.0

(a) Not separately reported by AEC on November 1, 1956.

Production of raw uranium ore actually declined during the first half of this year to about 1,620,000 tons, compared with 1,660,000 tons for the second half of 1956. The number of producing mines, however, remained about the same in each of the above periods.



WIRE ROPE AT WORK

One of the most interesting hoist installations in the country is now operating at the Cliffs Shaft Mine, owned by Cleveland-Cliffs Iron Company, Ishpeming, Mich. At the new "C" shaft, two friction-drive Koepe hoists raise and lower the skips, and a third takes care of the man and service cage. Speed for the skips is 1500 ft per min; for the cage, 1000 ft per min. Addition of these facilities has made it possible to hoist the mine's ore output in one shift per day.

The Koepe hoists, first installation of this type in the United States, are of the four-cable type using wire ropes of 1 in. diam. Balancing tail ropes are also employed on each unit. For the hoist cables, Bethlehem 6 x 27 flattened strand was chosen. For the tail lines, Bethlehem designed a non-rotating Seale. Both these classes of rope have given excellent service and they demonstrate clearly the importance of careful selection for specialized applications.

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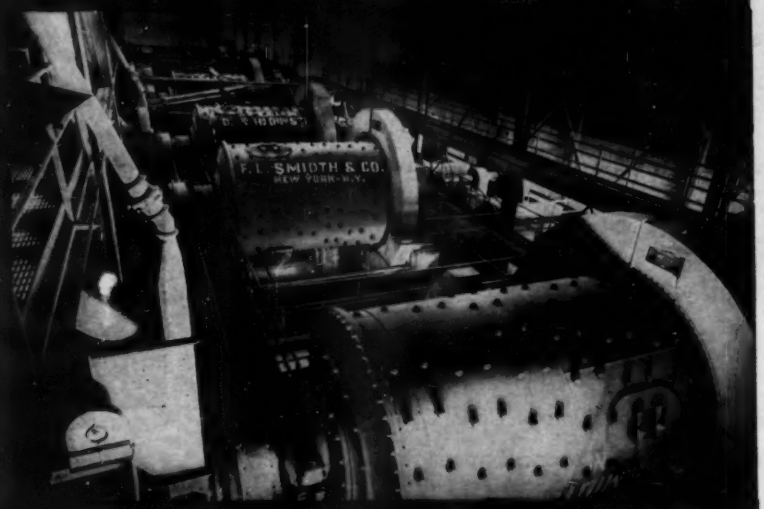

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Nordberg Machinery now in use by leading Taconite producers includes Symons® Primary Gyratory Crushers, Symons Cone Crushers, Nordberg Rod and Ball Mills, and Symons Rod Deck Screens.

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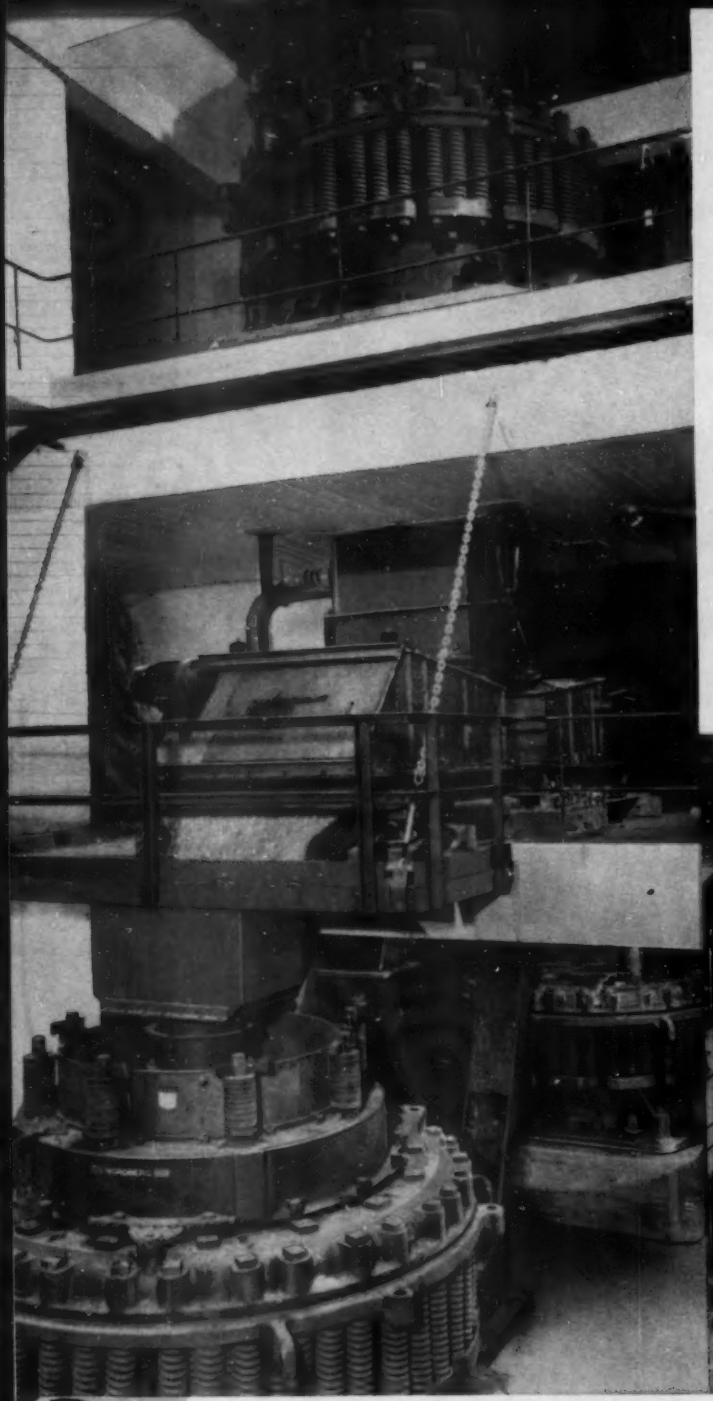

Typical arrangement of Symons Cone Crushers and Symons Vibrating Rod Deck Screens installed for secondary and tertiary crushing, and screening of Taconite ore. Cone Crushers of this type are built in sizes up to 7′ diameter, with capacities to over 900 tons per hour.

Battery of four Nordberg 10½′ x 16′ Rod Mills and eight Nordberg 10½′ x 14′ Ball Mills installed in a large Taconite concentrating plant. Other Nordberg Grinding Mills are built in sizes from 6′ to 13′ diameter and up to 50′ in length in Rod, Ball, Pebble, Tube and Compartment types.

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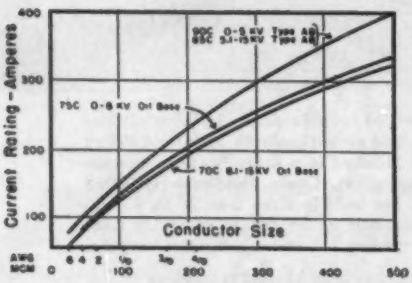
New cable insulation stops heat failures cold!



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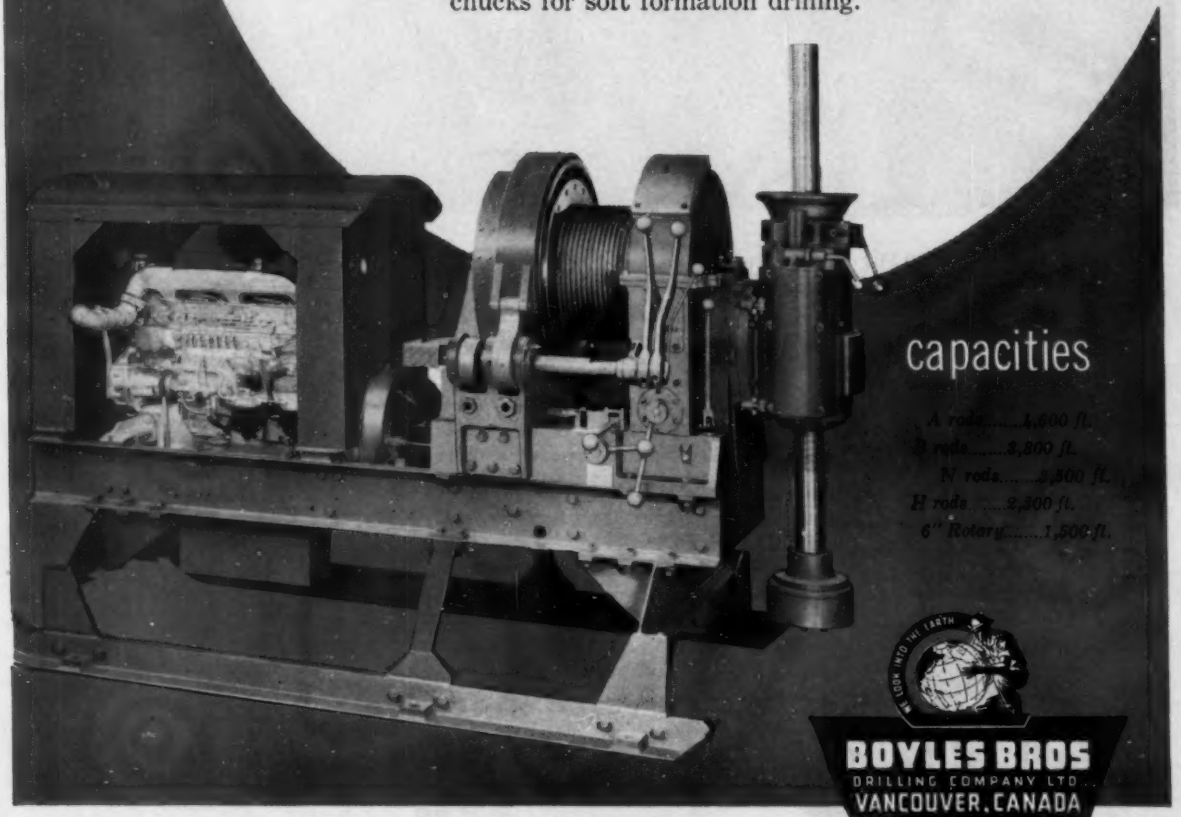

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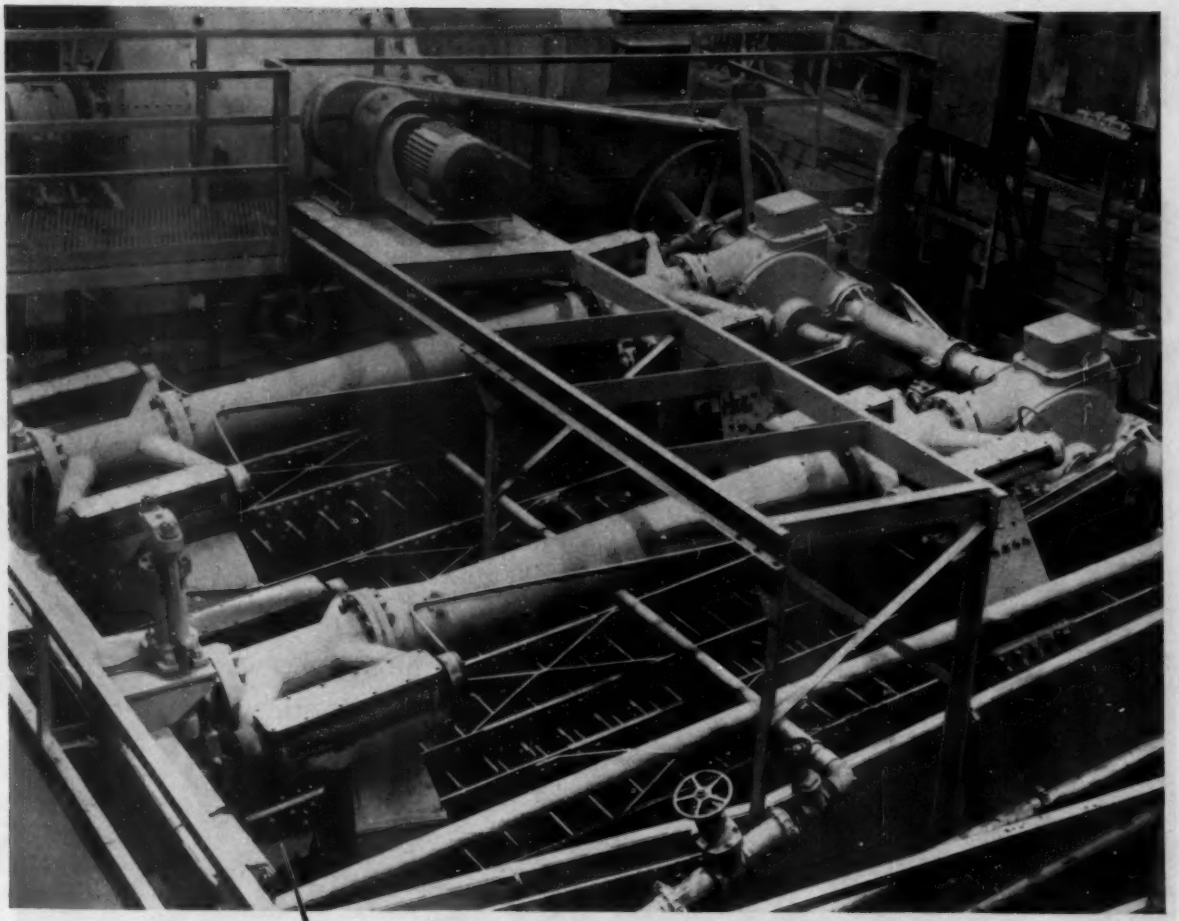


Idarado Mining Co. Classifies Complex Ore Body with DORR heavy duty Classifier

Rocky Mountain Mill Beneficiates 1750 TPD of complex ore containing copper — lead — zinc — gold & silver

Situated high in the Rocky Mountains in Colorado almost 9000 feet above sea level, the Pandora Unit of the Idarado Mining Company has encountered one of the most complex ore bodies in the Western United States. Consisting mainly of copper, lead, and zinc sulphides, the ore also contains recoverable fractions of gold and silver.

In the Pandora flowsheet an 8′ x 12′ rod mill receives 1750 TPD of minus 1″ copper-lead-zinc-ore. The rod mill discharge is jigged to recover gold and silver which is then sent to amalgamators. The balance of the rod mill discharge, which is approximately 30% minus 65 mesh, overflows to the Dorr Quadruplex Classifier. The Dorr Classifier, which is 16′ wide by 28′ long, is in closed circuit with ball mills and produces a 65 mesh separation at an overflow solids concentration of 35%. Overflow product goes to a conventional flotation circuit for subsequent recovery of the copper, lead, and zinc values.

For more information on Dorr HX Classifiers, write for a copy of Bulletin No. 2281. Dorr-Oliver Incorporated, Stamford, Conn.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH · ENGINEERING · EQUIPMENT
STAMFORD · CONNECTICUT · U.S.A.

The world of science behind
EXIDE-IRONCLAD BATTERIES

Being interviewed is W. W. Smith, Divisional Manager, Product Engineering. Grids in back are of Exide's exclusive Silvium. Those in front are ordinary alloys.

"All of these alloys had the same acid test"

At the Exide Laboratories—**Reporter:** Was it a typical charge-discharge test normally used to test battery components?

Smith: Right. And the two positive plate grids with no visible signs of corrosion are Exide's patented Silvium alloy.

Reporter: How about the others—what alloys are they?

Smith: They're standard alloys used in other well-known makes of batteries. But they don't have Silvium's corrosion-resisting ingredients.

Reporter: Where is Silvium used?

Smith: In the positive plates of all Exide-Ironclad and many other Exide Batteries.

Reporter: How does it affect battery performance?

Smith: Every test we've made proves it stretches battery life because the grid resists corrosion—sometimes up to 100% longer.

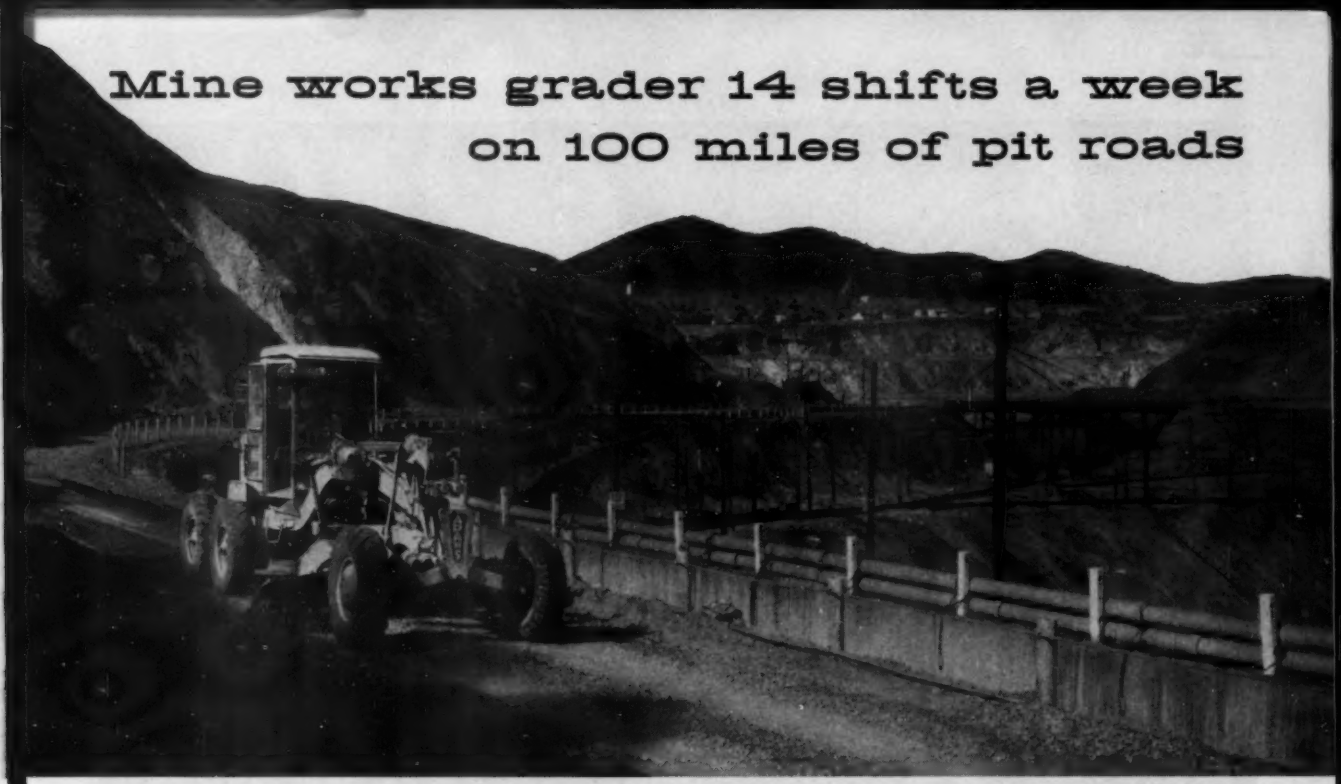
Reporter: Obviously this is an important feature of the Exide-Ironclad.

Smith: Yes it is, but it's just one of many engineering details that contribute to its high capacity and long life.

Note to battery users: Whenever you order heavy duty batteries or the equipment that requires them, be sure to specify Exide-Ironclad. For detailed bulletin, write Exide Industrial Division, The Electric Storage Battery Co., Philadelphia 2, Pa.

THE ELECTRIC STORAGE BATTERY COMPANY **Exide**®

Mine works grader 14 shifts a week on 100 miles of pit roads



Fast-moving Adams 550 grader does the biggest part of maintaining more than 100 miles of bench roads at big copper mine. This 123 hp unit grades, ditches, backslopes, does scattered clean-up work.

Two shifts a day, 7 days a week is the rugged schedule of work for a 550 Adams* motor grader at a big southwestern U.S.A. copper mine. 4 to 6 operators take turns manning this heavy-duty unit as it hurries about maintaining more than 100 miles of steep, winding mine roads.

Adams handles many jobs

Roads at the mine coil around the huge open pit, along wide benches 15′ to 20′ high. Surfaced with crushed stone, roads vary in width from one to six lanes. Usually working in 2nd gear, the Adams 550 grades fast and accurately. It ditches, backslopes, does all-around work — such as filling ruts, leveling ridges, and cleaning up debris fallen from banks or spilled from haul units.

Difficult assignments, long hours, are no problems for Adams graders. These graders are built to withstand severe stress and strain.

Structurally, the "550" has a big, all-steel box frame for lasting strength and rigidity. It is continuous-welded to take stresses as a unit — from bolster plate to boxed-in rear end. Streamlined, front to rear, this Adams frame has no sharp bends, no cross-section welds, no bolted or riveted joints to break. Front axle is made of welded heavy bar and plate . . . with yokes, kingpins, and spindles of forged, heat-treated steel. This rugged frame foundation, outstanding in the industry, is a basic factor in Adams' accuracy of control, low power loss, and speed as well as its dependability and economy of performance.

Power-wise, the two engines from which you can choose have been job-proven in more heavy-duty construction and road maintenance use around the world, than any other engines available anywhere. Mechanically, all gears and shafts run on anti-friction bearings, and all clutches slide on ball bearings. The 8-speed transmission is the finest ever built for use in a motor grader.

Adams lasts longer, works harder

Net result is a motor grader that lasts longer, works harder . . . with less upkeep. From the utility 220 model, with 60 hp . . . through 80, 115, 123, and 150 hp sizes . . . to the big torque-converter POWER-*Flow* 660, with 190 hp . . . Adams gives you more grader for your money.

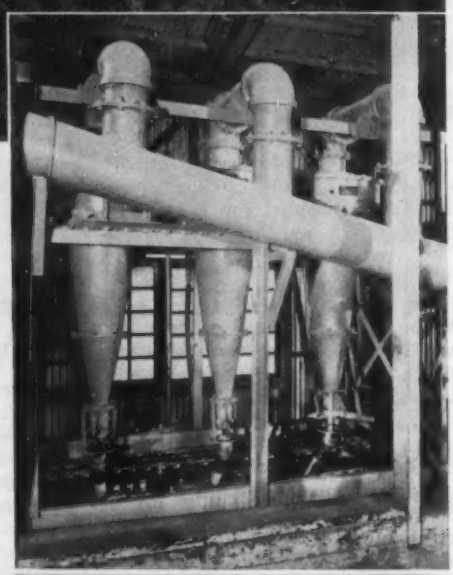
Look into the Adams line of heavy-duty motor graders. Your LeTourneau-Westinghouse Distributor has all the facts and will be pleased to give you more information on the model that fits your needs best.

Twisting uphill grading is done faster with Adams 550, because it offers *several* full-power speeds for each kind of work. With 15-speed transmission available, operator can always select gear that will get the most work done at the lowest cost. *Trademark G-1485-M-1r

LeTourneau-WESTINGHOUSE Company, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



This Krebs Cyclone installation paid for itself in 3 weeks

Acoje Mining Company, Zambales, Philippines is the largest metallurgical chrome producer in the Far East. A year ago Krebs Cyclones were installed to recover values from the slime reject. From the 2,000 gpm of slimes pumped to 3 cyclones, the fine crystalline underflows contain 65 tons per day of 20% Cr_2O_3. This fine scavenged concentrate is cleaned on tables to produce 21 tpd of 50% Cr_2O_3 concentrate adding 6% to 7% to plant recovery.

Krebs Cyclones are available in 17 models for a wide range of classifications. Unique design features, many patented, include a long involuted feed entry which sharpens classification. It also permits increasing the density of the overflow or reducing feed pressure for a specific performance.

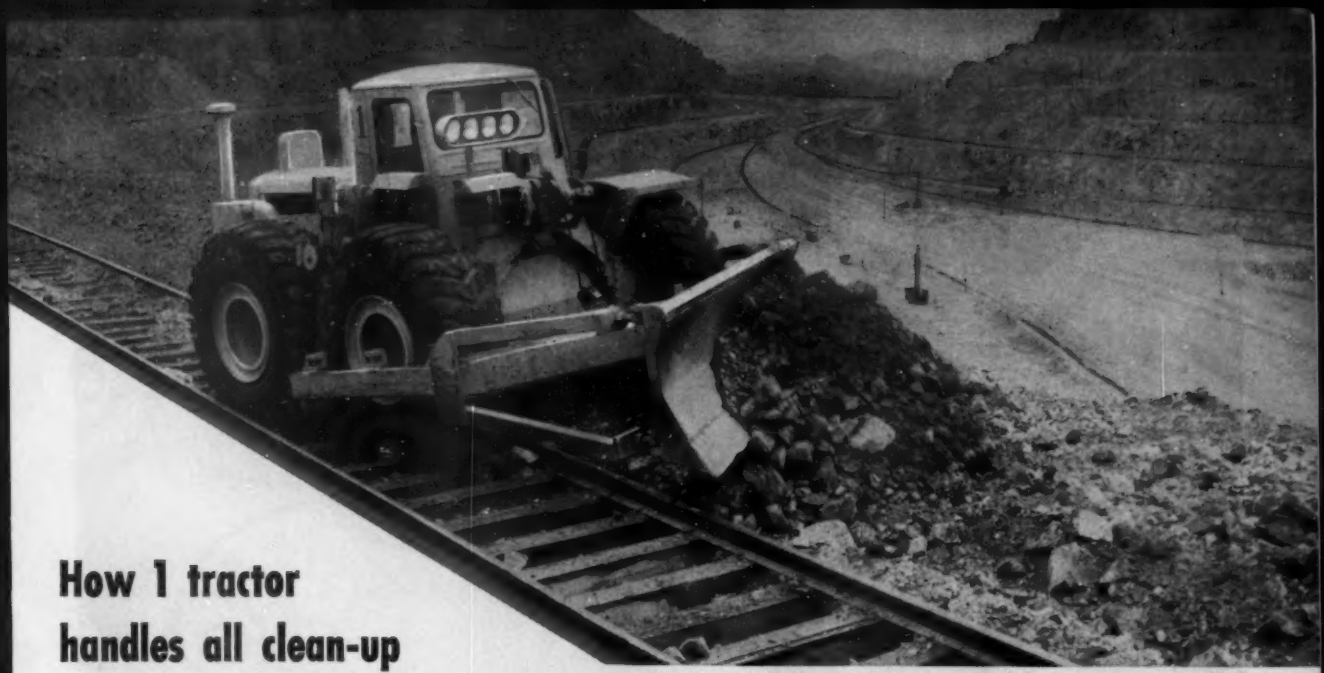
We invite your inquiry on the possible application of cyclone classification to your operation and offer the services of our pilot plant for full scale investigations.

EE PRODUCTS

EQUIPMENT ENGINEERS INC.

41 SUTTER STREET SAN FRANCISCO 4, CALIFORNIA

Manufacturers of Krebs Cyclones, Valves and Clarkson Feeders



How 1 tractor handles all clean-up around fleet of scattered shovels

At this large open-pit copper mine in Arizona, U.S.A., copper is produced from huge tonnages of rock and ore that are mined each day. Equipped with Angledozer and tilt mechanism, 210 hp Tournatractor makes quick work of clearing shovel-spillage from railroad tracks.

A large open-pit copper mine in Arizona, U.S.A., uses only one tractor for all clean-up around their widely scattered production shovels. It is the 210 hp rubber-tired LeTourneau-Westinghouse Tournatractor®. Here is how this 17 mph rig works during typical 8 hr. day:

Averages 10 min. per shovel

When the 6-yd. shovels have completed loading a string of ten to twelve 84-ton capacity rail-cars, Tournatractor drives in and goes to work. Straddling the rails, this rubber-tired tractor efficiently dozes shovel spillage off tracks with its Angledozer* blade. At each shovel, speedy Tournatractor cleans-up loading area and railroad track in about 10 minutes!

Takes shortest route to next location

When each assignment is finished, Tournatractor operator just flips instant-shift lever and he is on his way to the next shovel. There are no delays for crawling or load-and-haul to new location. A mile is only a couple minutes away! Tournatractor always takes the shortest, fastest route to the next work location... often travels down steep banks to lower benches. Big, low-pressure tires do not damage air-drill hose lines, railroad tracks, ties, switches, or haul road surfacing.

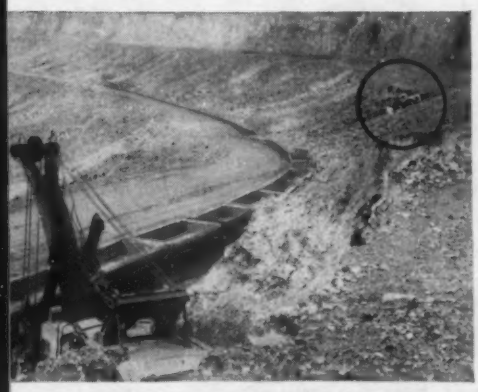
"You cannot beat Tournatractor"

Handling all clean-up work for the shovels... plus completing numerous scattered maintenance jobs during his 8 hour shift...Tournatractor operator said, "You cannot beat this tractor for clean-up work. This is the place for rubber... I can move around faster than a pick-up truck on some of our benches."

For more information

If you use several crawler-tractors for clean-up at your pit, plant, and stockpiles, investigate how Tournatractor's power, traction, speed, and mobility can help you. Write us for more information on Tournatractor and other LeTourneau-Westinghouse equipment.

*Trademark CT-1482-M-1r



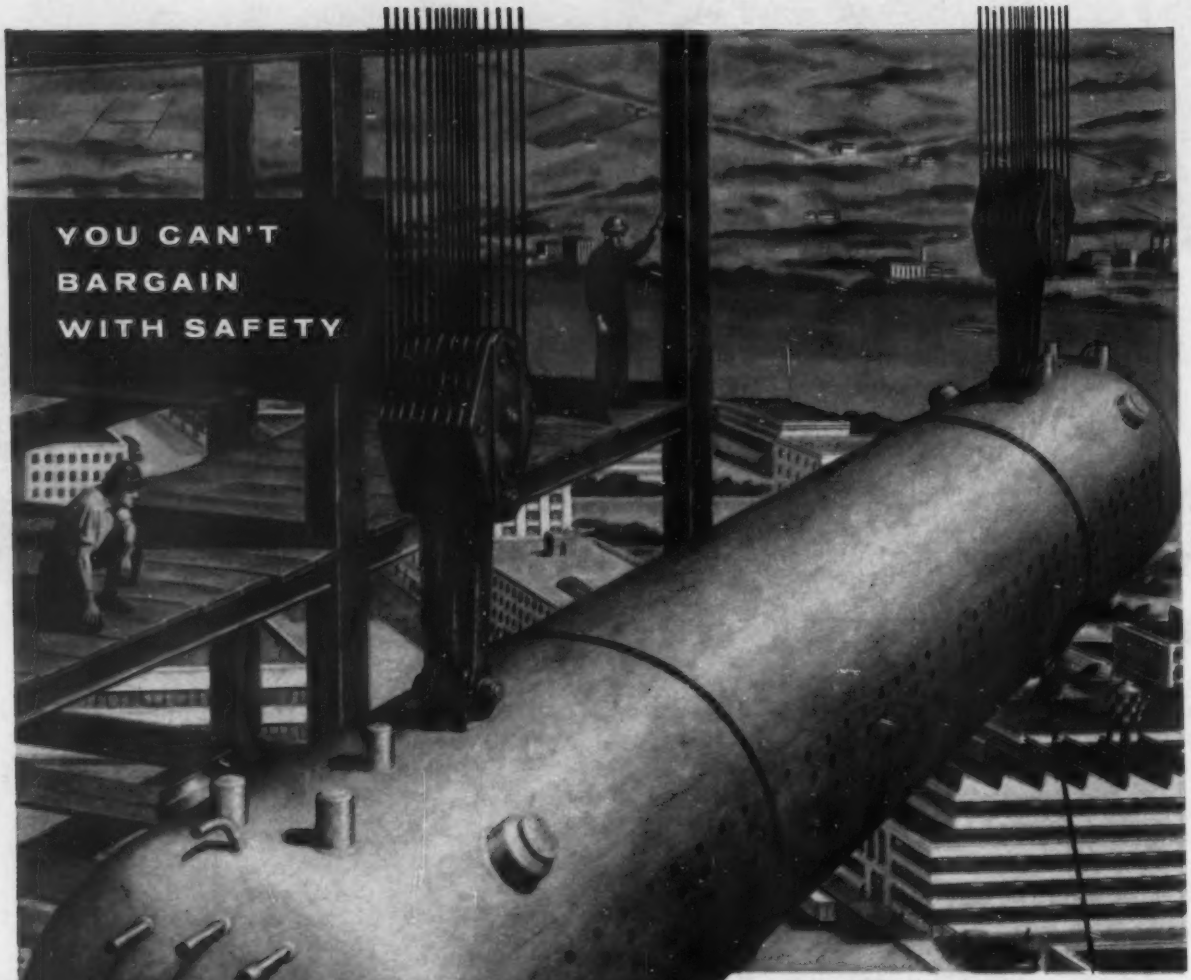
Go-anywhere Tournatractor "runs" down a steep bank to shorten travel time between shovels. With big, multi-disc air brakes — totaling 3,762 sq. in. of brake surface — operator has sure, safe control at all times.

Crossing tracks, Tournatractor's big, low-pressure tires deflect to prevent damage. They do not loosen rails, damage ties or switches.

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



This 240,000-pound steam drum, built by Combustion Engineering for a large generating plant, is here being hoisted 120 feet into position by strong wire rope. It's a striking example of how . . .

safety rides on quality wire rope

You may never hoist loads as large as this 120-ton drum. But *safe, top quality wire rope is just as important to your own operations.* For, although the price of a "bargain" rope would be less, failure of such a rope could cost you thousands of dollars in wrecked equipment. Don't be a victim of false economy. Buy a wire rope that's a quality rope—buy Wickwire Rope.

5339

WICKWIRE ROPE — A CF&I PRODUCT

CF&I

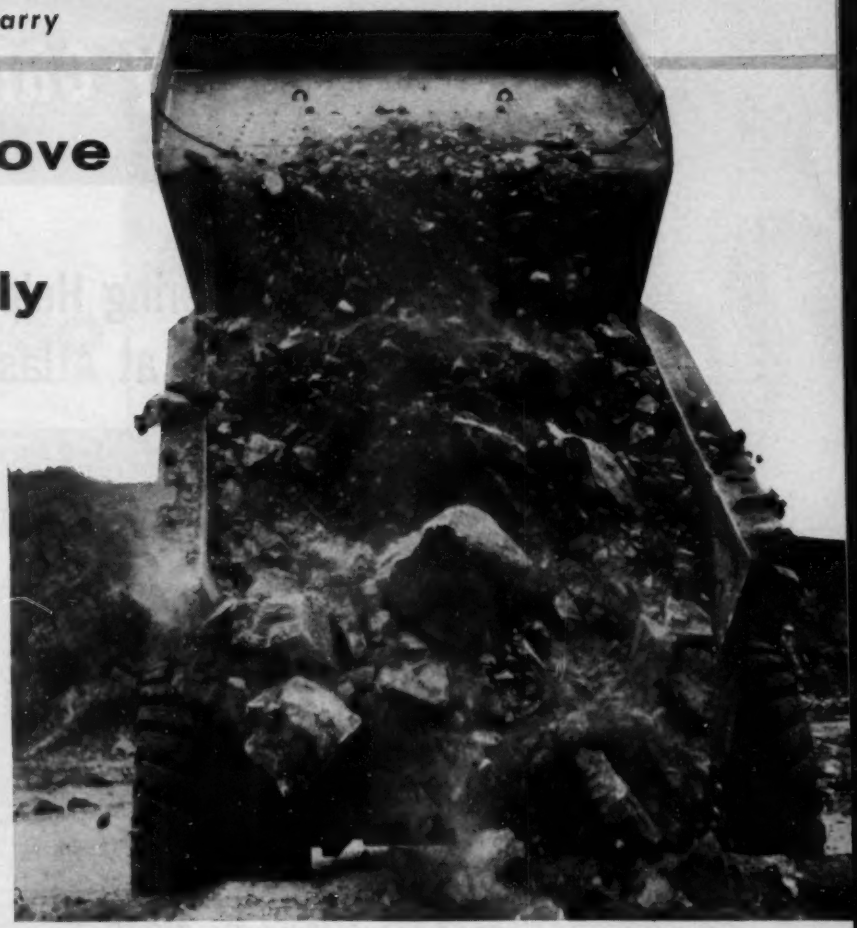
LOOK FOR THE YELLOW *TRIANGLE*

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Casper • Denver • El Paso Farmington (N. M.) • Fort Worth • Houston • Kansas City • Lincoln (Neb.) • Odessa (Tex.) • Oklahoma City • Phoenix • Pueblo Salt Lake City • Tulsa • Wichita • **PACIFIC COAST DIVISION**—Los Angeles • Oakland • Portland • San Francisco • San Leandro Seattle • Spokane • **WICKWIRE SPENCER STEEL DIVISION**—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.) New Orleans • New York • Philadelphia

At a German limestone quarry

2 haulers move 180 tons of rock hourly



At an important quarry, south of the Ruhr area, in Germany, two Model C Tournapull Rear-Dumps haul out about 180 tons of blasted limestone rock each working hour.

The German firm, Rheinisch-Westfalische Kalkwerke-Aktiengesellschaft, Dornap, is using these modern, heavy-duty haulers in removing the top layer of a limestone hill at the company's Honnetal quarry. This quarry supplies lime to the chemical and construction industries, as well as to the steel mills of the Dortmund-Hagen area. Limedust from this plant is also used in mines to control fires and explosions.

Body design withstands shock loads

A shovel loads the two LeTourneau-Westinghouse Rear-Dumps (one with an earlier 18-ton capacity, the other a current 22-ton model) with large chunks of limestone. The Rear-Dumps' egg-shaped bowl design tends to safely deflect the shocks of loading. According to extensive tests made in this quarry, trucks with a box-shaped body could be loaded to only 70% of capacity, while 'Pulls were consistently loaded to 85% and 90% of capacity.

During typical operation, Rear-Dumps haul rock about 1150 feet over the rough pit floor from the shovel to the crushing plant. Each unit delivers about 90 tons of limestone hourly, according to Dipl. Ing. Hettwer, the Technical Manager of the quarry.

Tournapulls also haul out large amounts of waste loam and clay from fissures in the rock. On the waste dump, Tournapulls' big, low-pressure tires and power-transfer differential (which channels more power to the drive wheel on firmer footing) provide ample flotation and traction for hauling across loose fill.

Despite the constant shocks of loading this heavy limestone rock, and of hauling over a rough, rocky surface for 16 hours daily, Tournapull Rear-Dumps have needed little repairs. One Tournapull has worked for more than 2¾ years; a second machine for longer than two years. Most months, the Rear-Dumps' operating efficiency record is over 90%.

Maneuverability saves time

At times, other types of haul units have been used for transporting rock here. However, they were unable to turn within the narrow space between the pit wall and the shovel's power cable in order to position for loading. Consequently, a bridge had to be laid over the cable for them to drive across.

In contrast, Tournapull Rear-Dumps, with their 90° kingpin power-steer, can turn easily in the cable-to-wall space, eliminating the time-robbing practice of having to lay, move, and maintain a plank crossing over cable.

If you have heavy material to move, or if you must work in a confined space, you will want to investigate the advantages of Tournapull Rear-Dumps: available in 11, 22, and 35-ton sizes. Write us for information on LeTourneau-Westinghouse equipment.

Tournapull—Trademark Reg. U.S. Pat. Off. CR-1386-Q-br

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

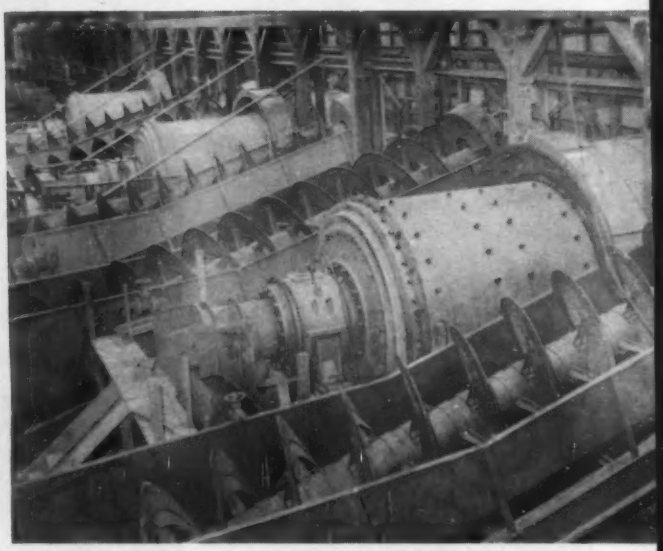
A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

see what Marcy can do for YOU!

Marcy Engineering Helps Increase Efficiency and Production at Atlas Consolidated

Atlas Consolidated Mining and Development Co., Island of Cebu, P.I., recently completed installation of the three 10' x 10' Marcy Grate Discharge Ball Mills shown in photo. In addition they have ten No. 86 Marcy Grate Discharge Ball Mills. These mills were engineered and manufactured by Marcy; and sold and serviced by Marcy's representative, Edward J. Nell Co., Manila.



Over the past years the foresight of Colonel Andres Soriano, President, and the staff of Atlas Consolidated Mining and Development Co., has paid off in greatly increased production of base metals. This increased production has been made possible by their aggressive planning . . . including the addition of larger diameter Marcy Ball Mills, which resulted in increasing the operating efficiency. Also, the ten No. 86 Marcys, after many years of operation, have been modernized . . . again with the purpose of increasing efficiency. The present grinding capacity of this plant is now 13,000 to 14,000 tons per day.

This is another example of how Marcy engineers have played an important part in helping a company in expanding its facilities and increasing efficiency . . . you, too, can have the advantage of this experience. Write, wire or call.

NO EXTRA CHARGE FOR MARCY EXPERIENCE

THE MINE AND SMELTER SUPPLY CO.

DENVER NEW YORK SALT LAKE CITY EL PASO

SALES AGENTS AND LICENSED MANUFACTURERS THROUGHOUT THE WORLD

this is the **TS-360**

15 yd struck
20 yd heaped
280 horsepower

this is the **TS-260**

11 yd struck
14 yd heaped
200 horsepower

now...

ALLIS-CHALMERS BRINGS YOU ANOTHER NEW MEASURE OF MOTOR SCRAPER PERFORMANCE

the TS-160

NEW Allis-Chalmers TS-160

7 yd struck

9.5 yd heaped

155 horsepower

5 speeds to 25.4 mph

12-ton payload

Measure these advantages for

22 hp per struck yard—Big Allis-Chalmers supercharged diesel engine delivers extra lugging ability for tough pulls, fast loading. Versatile TS-160 can team up with big equipment or work alone on long- or short-haul stripping jobs—handle a wide range of utility jobs, travel at speeds up to 25.4 mph.

Measure these features . . . Allis-Chalmers 516-cu-in. diesel engine—dependable power at all working speeds • Independent, constant live hydraulic power for steering and scraper operation • Low, wide bowl—8-ft, 1½-in. cutting edge . . . 3-piece, interchangeable cutting edges . . . double-acting hydraulic bowl lift jacks • Positive hydraulic ejection, high apron lift to full 7-ft, 1½-in. opening • Roomy operator's compartment, easy-to-reach controls, 24-volt direct electric starting, adjustable bucket-type seat, synchronized 4-wheel air brakes • Big push block for all types of pushers—positioned for in-line push • Full-circle visibility while loading, spreading and traveling . . . operating ease under all conditions • 17¾-in. minimum ground clearance in hauling position.

a wide range of earthmoving jobs . . .

Turns non-stop in less than 25 ft with 90-degree hydraulic steering . . . easy maneuverability in narrow cuts, faster cycles without reversing in tight turn-arounds.

Moves quickly from job to job . . . when required, transport wheels are available to meet legal load limits for highway travel.

Allis-Chalmers, Construction Machinery Division
Milwaukee 1, Wisconsin

ALLIS-CHALMERS

Engineering in Action

GENTLEMEN: Have the Allis-Chalmers Construction Machinery dealer serving my area arrange a demonstration of the TS-160 motor scraper for me ☐.

Name_____

Address_____

City_____ State_____

Type of work_____

In Utah . . . and the World Over
BUCYRUS-ERIE ELECTRIC SHOVELS HELP KEEP HAULING UNITS ON THE GO!

This Bucyrus-Erie 110-B with 4½-cu. yd. dipper is loading out waste rock at a vast copper mining project in Utah.

Dependability is a big reason why Bucyrus-Erie electric shovels keep haul units on the go the world over. The heavy-duty construction of these shovels lets them take over the tough work . . . and keep working day after day, year after year. The exclusive two-section boom, tubular dipper handle and twin dual hoist combine to provide great strength, while reducing power-consuming deadweight. Strain on swing machinery is reduced . . . work cycles speeded.

And Bucyrus-Erie electric shovels are as productive as they are dependable. With the tubular dipper handle free to turn in the saddle block when digging strains fall heavier on one side of the dipper than the other, torsional strains in the handle itself are eliminated. The twin dual hoist ropes pull the dipper straight through the toughest banks. Let us tell you more about the proven dependability and big output of Bucyrus-Erie electric shovels. Write for full information.

143L57C

BUCYRUS-ERIE COMPANY

South Milwaukee, Wisconsin

NATIONAL GYPSUM (Canada) Ltd. keeps stripping and production on schedule

with "Euc" Scrapers and Rear-Dumps

Euclid equipment proved its reliability and work-ability in the conversion of a peaceful farming area around Milford, Nova Scotia to a gypsum quarry.

Faced with moving a million bank yards of clay and 500,000 tons of gypsum rock, National Gypsum evaluated all makes of equipment—bought four "Euc" Scrapers, including an 18-yard Twin-Power model, and six 22-ton Rear-Dump Euclids for the rock movement. Sixteen months after the starting date, this big quarry site was stripped and graded—right on schedule. To fully clean the initial 15-acre quarry block, 7 million yards of clay are expected to be moved.

During early production at the quarry, four Rear-Dumps were hauling 5500 tons of ore to the hopper in an 8-hour shift. The haulage fleet is now composed of 10 of these reliable 22-ton "Eucs" used in the quarry and in the stripping operation in conjunction with a dragline. Six Euclid trucks currently used in the quarry deliver up to 1000 tons of gypsum per hour to the primary crusher bin.

Have your Euclid dealer give you information on the complete line of Scrapers, Rear-Dumps, Bottom-Dumps and Crawler Tractors...he has proof that ***Euclids are your best investment.***

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

LOW COST
CONCENTRATION

ANTHRACITE COAL
BARITE
CASSITERITE
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ILMENITE
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MARTITE
MONAZITE
MUSCOVITE
NATIVE COPPER
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RUTILE
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TANTALITE
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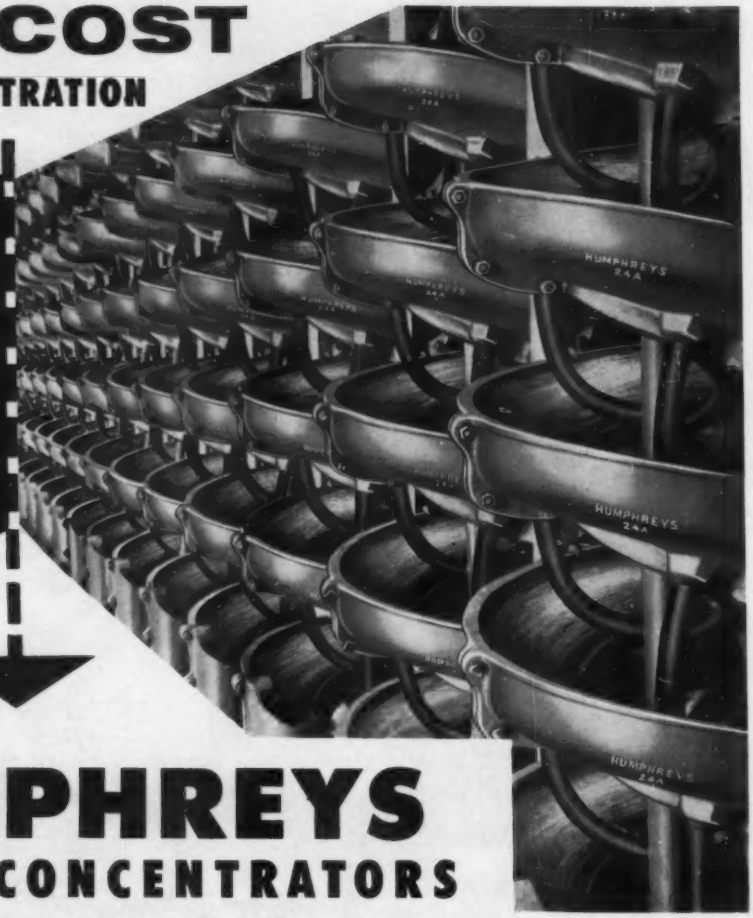
WOLFRAMITE
ZIRCON



HUMPHREYS
SPIRAL CONCENTRATORS

HAVE ECONOMICALLY RECOVERED THE MINERALS LISTED ABOVE

Low cost concentration becomes a reality when you install Humphreys Spirals. Economy-minded mineral producers the world over prize these efficient concentrators, their economical installation, low maintenance costs and year-round trouble-free operation. No moving parts. Small floor space.

APPLICATIONS:

Production of a finished concentrate.

Production of a bulk concentrate of several minerals and a finished tailing in one or more stages.

Scavenging the tailing from another process for the recovery of heavy minerals.

Write today for information on metallurgical tests of your ore samples for spiral treatment.

THE HUMPHREYS INVESTMENT CO.

Engineering Division · **913 FIRST NATIONAL BANK BLDG.** · **DENVER 2, COLORADO**

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SWEDEN:
SALA MASKINFABRIKS A-B,
SALA

SALES AGENT—ENGLAND· THE GENERAL ELECTRIC CO., LTD. (FRASER & CHALMERS ENGINEERING WORKS) ERITH, KENT

powered by White's Superior Diesel

Manitowoc 4500 cuts Ohio Stripper's cost 20%

Careful equipment selection is paying off for Terramana Brothers Coal Co., Steubenville, Ohio. For digging into 70 feet of overburden, they chose a Manitowoc 4500 shovel . . . and wisely specified the rugged, dependable White Superior Diesel for power. According to Terramana Brothers, this perfect combination greatly increased production and cut operating costs . . . resulting in more than 20% overall savings!

The big 4-yd. rig with a 60-ft. boom and a 45-ft. stick works two 10-hour shifts daily, powering away almost 400 yards per hour. The high torque Superior engine provides more line muscle . . . it pulls a full dipper with little effort. Under light load, it enables swings at top speed without surging. The faster and smoother cycle increases production!

Many cost saving advantages of Superior's design simplicity also contribute greatly to this economy. Easy accessibility of internal parts speeds servicing in close quarters. Down-time is practically eliminated because maintenance and repairs are reduced to a minimum. Many case histories show 35,000 engine hours with no major replacement parts required. Superior's first valve job usually comes due long after other engines would be completely replaced! Highly developed, open chamber combustion achieves optimum air and fuel mixture, low fuel consumption and easy starting. Precision construction throughout reduces wear and assures lowest lube oil consumption.

Specify White's Superior Diesel on your next new shovel or when you're re-powering. Power ranges from 225 to 2150 B.H.P. for all types of service. *Write for complete information today.*

White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY

Plant and General Offices: Springfield, Ohio

NOW . . . DRILL 9" HOLES WITH THE NEW JOY 59-BH CHAMPION

This world-famous pioneer rotary-air-blast-drill has adopted many of the features of its big brother, the Super-Heavyweight, to give you these advantages:

MORE STABLE DRILL STRING through use of round pipe . . . BETTER AIR CIRCULATION and cuttings removal . . . FASTER DRILLING—faster retraction of hydraulic feed averages total of only 3 minutes on a 51′ hole . . . EXTENDED 55′ MAST permits drilling 50′ hole without adding pipe . . . BETTER MOBILITY —hydraulically raised and lowered mast is left assembled during long moves . . . 9″ HOLE allows wider hole spacing, economical use of large diameter powder.

This all adds up to new records in low cost per ton of rock. Get the whole story on the 59-BH. Write to ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.

Write for Bulletin 168-8

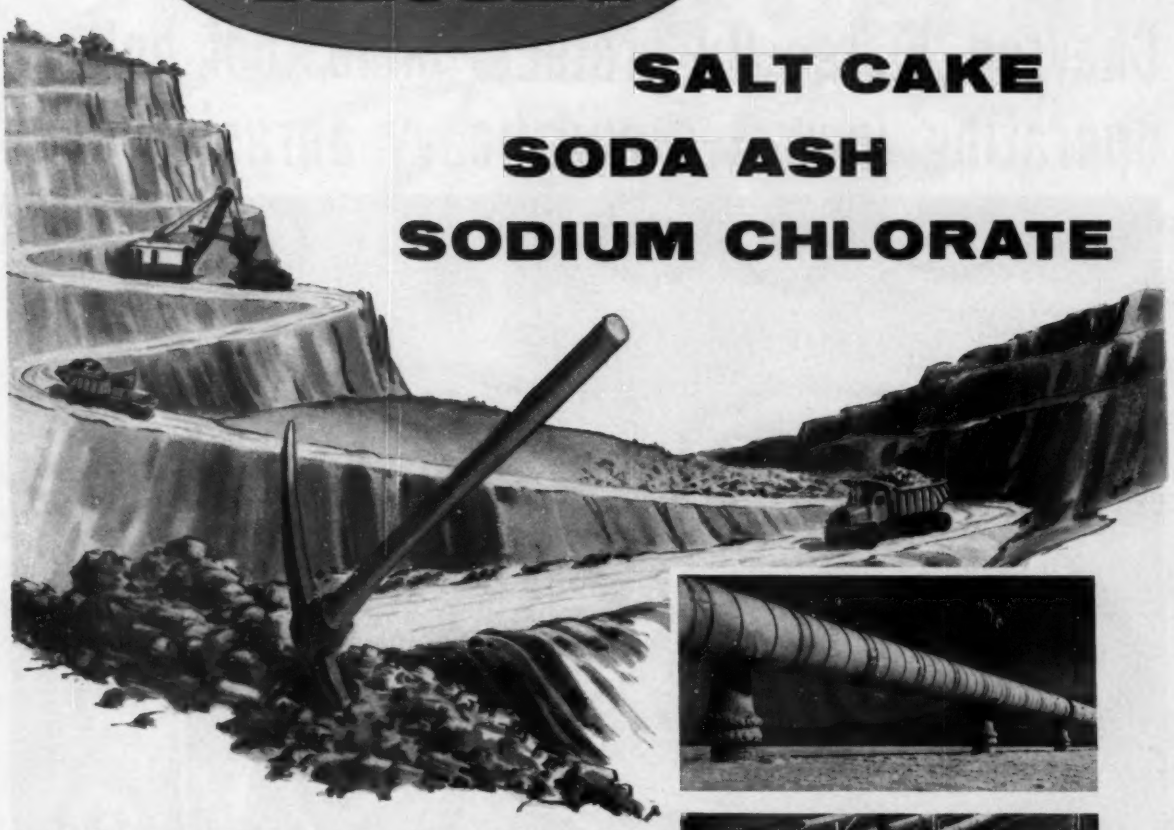
JOY . . . EQUIPMENT FOR MINING . . . QUARRYING . . . CONSTRUCTION

WSW M 6565-168

PORTABLE AND SEMI-PORTABLE AIR COMPRESSORS • ROCK DRILLS • WAGON DRILLS • DRILL BITS • BACKFILL TAMPERS • SPADERS
PAVING BREAKERS • SHEETING DRIVERS • DRIFTERS • PORTABLE HOISTS • FANS AND BLOWERS • PORTABLE SAFETY LIGHTING

TRONA

SALT CAKE
SODA ASH
SODIUM CHLORATE



At Trona, California (top view) high purity Soda Ash and Salt Cake are recovered from the chemical-rich brines of Searles Lake. The Henderson, Nevada, plant (bottom view) produces highest grade Sodium Chlorate by electrolytic processes.

pick of the mining world

TRONA* Salt Cake, Soda Ash and Sodium Chlorate are improving ore processing everywhere—getting through to pay dirt faster, adding the mark of quality to ore concentrates. In the refining of lead dross and non-ferrous metals, TRONA Salt Cake and Soda Ash provide more effective and thorough ore treatment. In uranium and similar ore processing, TRONA Sodium Chlorate speeds oxidation, upgrades refining action. For your refining process TRONA Chemicals assure a hard working, uniform crystal that improves quality and increases mineral recovery. Make TRONA your choice for faster, more profitable processing. Ample supply and quick delivery are possible—*anywhere.*

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ENGINEER'S FIELD REPORT

LUBRICANT CHEVRON* VISTAC OIL

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Chevron* Vistac Oil protects mine roof bolters operating in water and heavy abrasive dust

WORKING CONSTANTLY in heavy abrasive dust, high humidity and water in one of Utah's largest coal mines, these Joy roof bolters are lubricated with Chevron* Vistac Oil. To eliminate crossbar timbering and provide greater safety and increased production, these air tools drill holes, hammer bolts and tighten nuts on steel bearing plates. Bolts up to 8 feet long are rammed in to refusal at pressures up to 3,000 lbs. psi.

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For More Information about this or other petroleum products of any kind, or the name of your distributor, write or call any of the companies listed below.

* The Chevron Brand covers the line of industrial products formerly sold under the Calol name. This is a name change only. The high quality and specifications remain the same.

CHEVRON Industrial Lubricants

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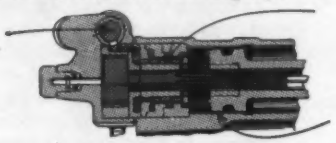
Why Chevron* Vistac Oil cuts costs in air-tool equipment



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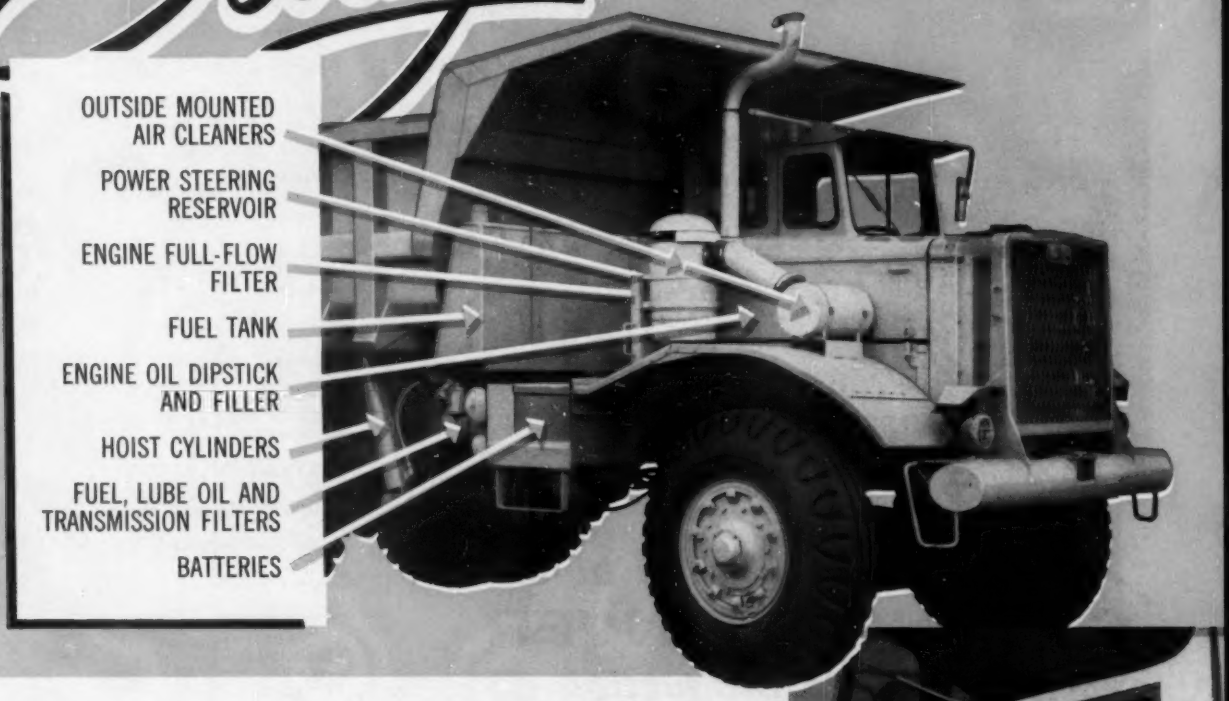

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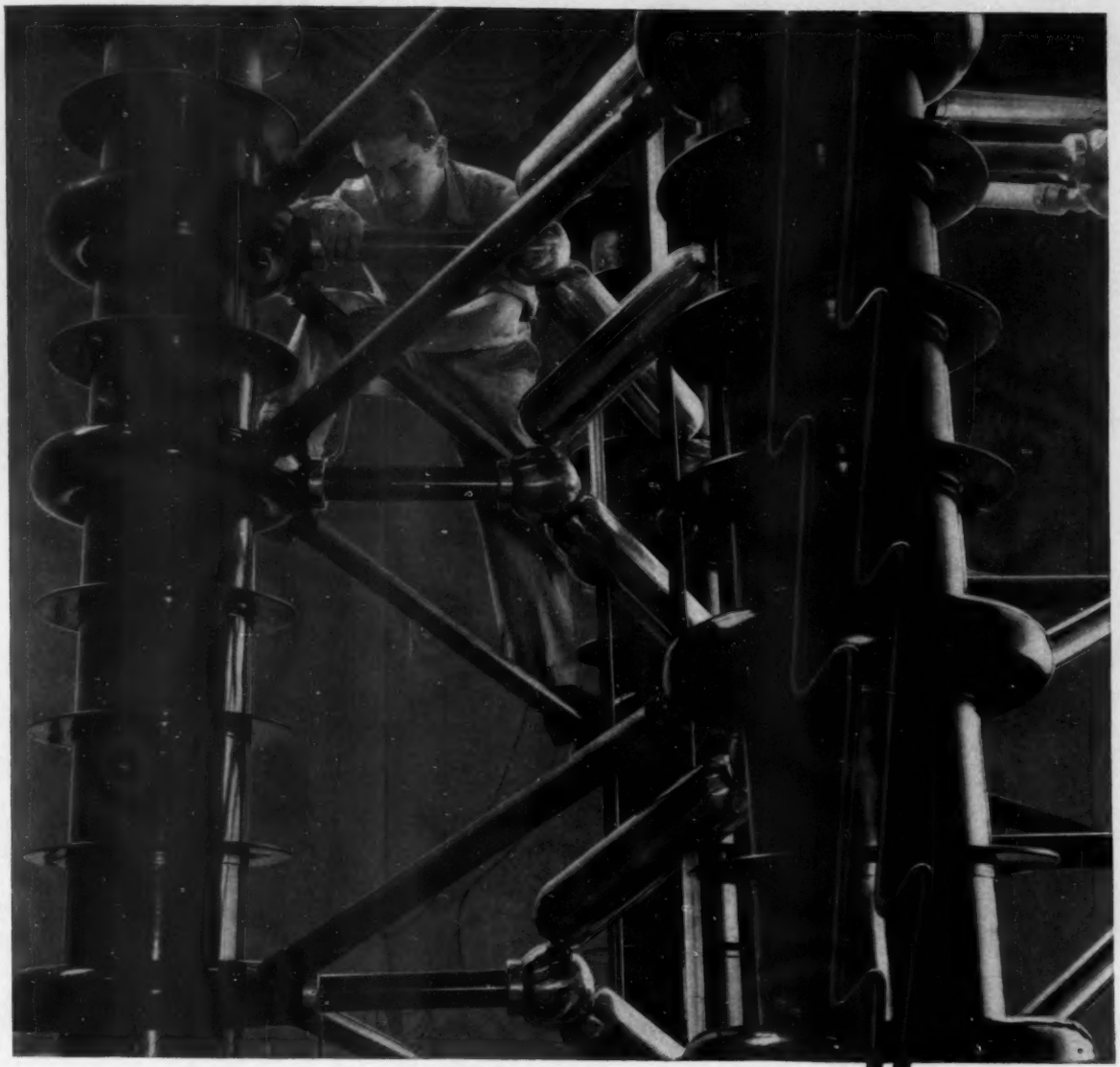

Simplex Wire & Cable Company's new 1,400,000 volt impulse generator — the first of its kind to be installed in North America — represents just one aspect of research at Simplex. Simplex scientists and engineers originated the process of vulcanizing portable rubber cords and cables in a lead mold. Simplex developed the first heavy-duty portable electrical cable — Simplex TIREX. The first truly moisture-resistant rubber insulation was the outcome of a commercially acceptable method of deproteinization developed by Simplex. Simplex designed the first interlocked armored cable for underground service — Simplex CONDEX. And now — Simplex C-L-X — the portable, corrugated metallic duct WITH SEALED-IN CABLE. **SIMPLEX WIRE & CABLE CO.**, Cambridge, Massachusetts and Newington, New Hampshire.

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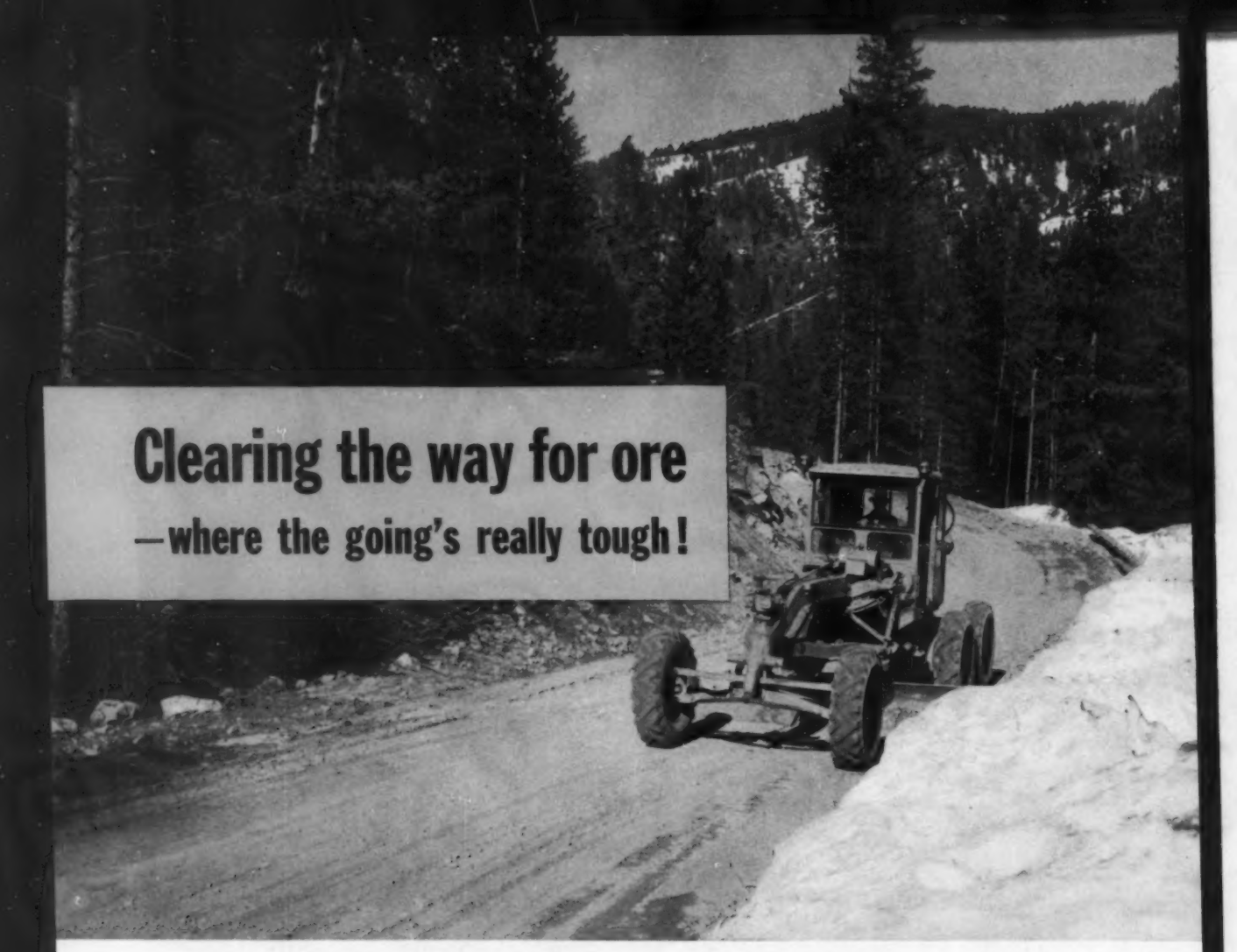

Clearing the way for ore

—where the going's really tough!

This is a mine haul road on Forest Service land about a dozen miles out of Lowman, Idaho. A CAT* No. 12 Motor Grader maintains 22 miles of it for Hi Dayley of Boise, under contract to Porter Bros. Corp.

Porter Bros. own two dredge mines near Bear Valley, working rare earths—uranium, monazite, titanium and other minerals. They need this road 12 months of the year. It's always a rugged maintenance job for the No. 12—mountainous, sandy, rocky. But this photo was taken in May, and during the winter the temperature dives to 56° below and the snows level off at around 11 feet. Still the No. 12 clears the way for the ore haul, day in, day out. When the snow is deep, the Domor Snow Blower is used to move the snow well back from the roadside.

The Cat No. 12 is a tough, smooth-working machine, made for rough duty like this. Its new oil clutch means better, easier operation and considerably less maintenance. Its controls are mechanical: fast and positive. It can swing that long-life blade from ditch cut to bank cut in less than a minute, without link adjustment. It features convenient in-cab starting, excellent visibility (notice the operator sitting down) and many other advantages. Its powerful 115 HP Cat Diesel Engine runs smoothly and faithfully on low-cost non-premium fuels.

For full details on the No. 12—product of the world's largest manufacturer of motor graders—see your Caterpillar Dealer. See him, too, for expert service, and for replacement parts you can trust.

Caterpillar Tractor Co., San Francisco, Calif.; Peoria, Ill., U. S. A.

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We'd be the last to claim that Amsco® Dippers have any inherent glamour. That's why we induced the pert 115-pound* blond to pose in one of our 7-yd. dippers at a recent trade show. Got a lot of attention, too!

But we know that experienced operators *specify* these all-cast Manganese Steel Dippers because they're real "beasts"—when it comes to strength and ruggedness. By way of proof, glance at the other photo. It shows a 9-yd. Amsco Dipper hoisting a 60 to 70-ton* rock out of the St. Lawrence Seaway Channel. There's plenty more proof available, too—on the extra strength, digging ability and long life of Amsco Dippers. That's why they're the number one original-equipment choice on most leading makes of power shovels!

Consult your equipment manufacturer, or write us direct for new booklet on *Amsco Power Shovel Equipment*, giving detailed reasons why Amsco Dippers are real "beasts" when it comes to rugged digging work.

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MAGNETORQUE®... the electro-magnetic type coupling that transmits power from the hoist motor to the dipper for faster action, eliminating shock and impact to the hoist gear train and motor. Response is immediate to varying load conditions.

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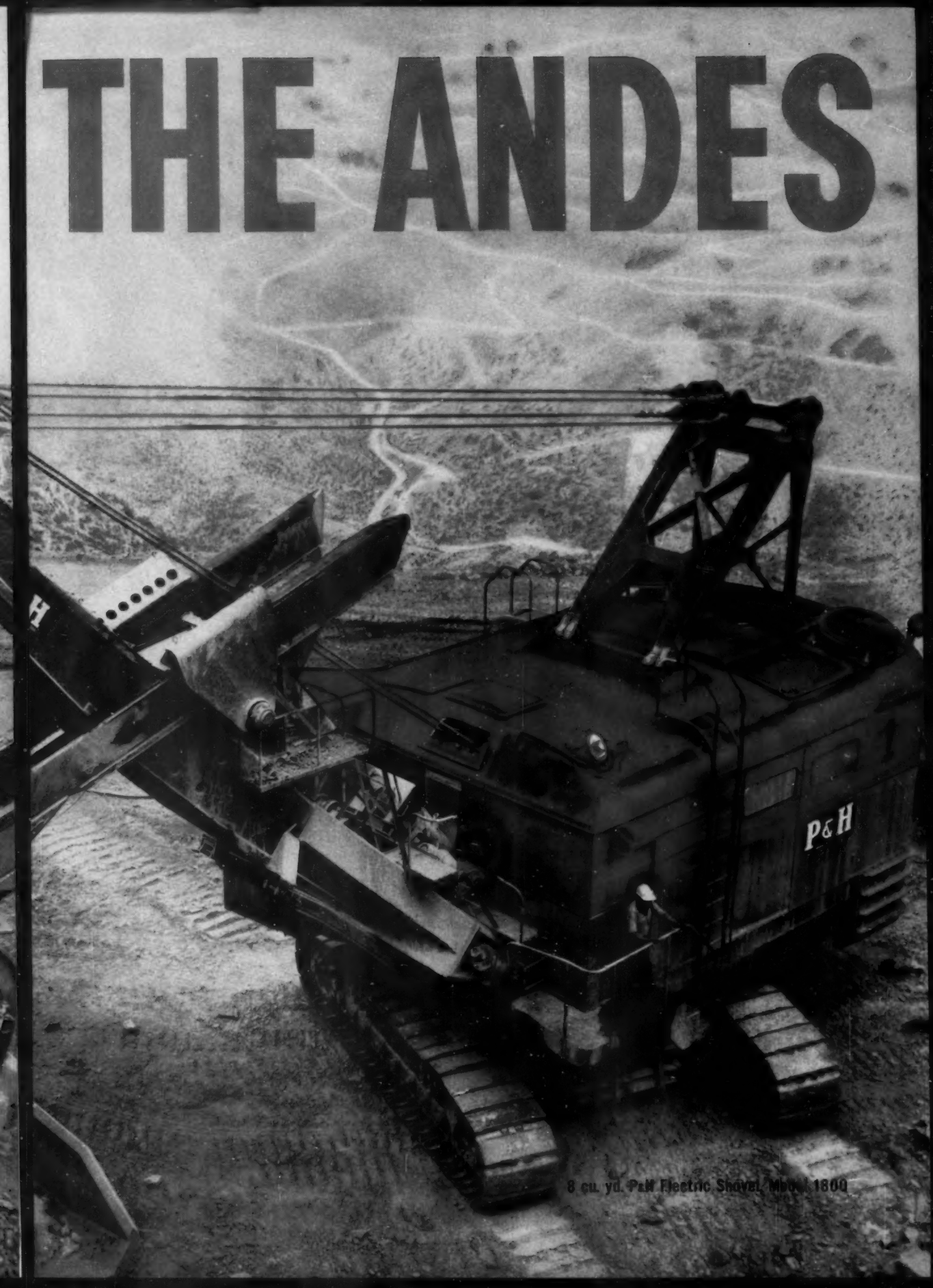
THE ANDES



8 cu. yd. P&H Electric Shovel, Mod. 1800

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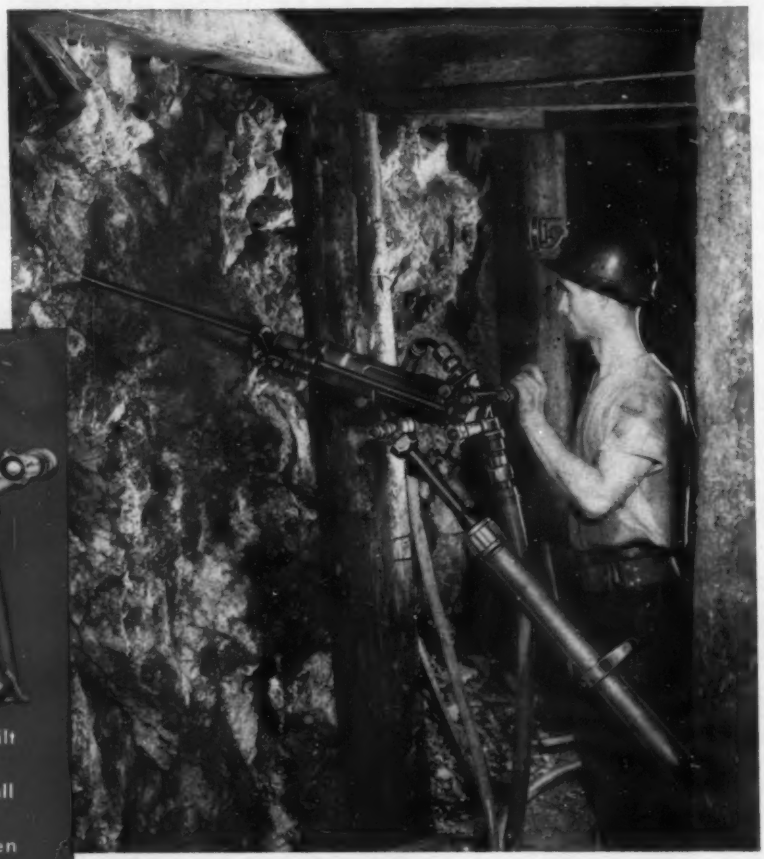
UNIVERSAL JACKDRILL

gives you MAXIMUM FOOTAGE PER SHIFT at LOWEST OVERALL COST



FEATURES

- Roll-Type Feed-Leg Valve built into handle
- Five-Position Throttle controls all functions
- Built-in Air Connection between drill and leg
- Adjustable Tension on hinge joint
- Adjustable Balance for easy handling
- Enclosed Steel Centralizer
- Constant Chuck Blowing
- One-Piece Chuck with renewable bushing
- Extra-Rigid Fronthead Construction
- Lighter Weight Telescopic Leg

Set-up time can be converted to drilling time with the Ingersoll-Rand JR-38B Jackdrill — the easiest-handling one-man universal drilling unit ever developed. Designed to take full advantage of the inherent economies of 1⅜" Carset Jackbits, it saves drilling time, too, and reduces air requirements as well. The JR-38B is rugged — it stays on the job. These savings add up to maximum footage per shift and a new low in drilling costs.

The features at the left give some of the reasons for this outstanding Jackdrill performance. For the complete story, see your I-R man or send for a copy of Bulletin 4144A.

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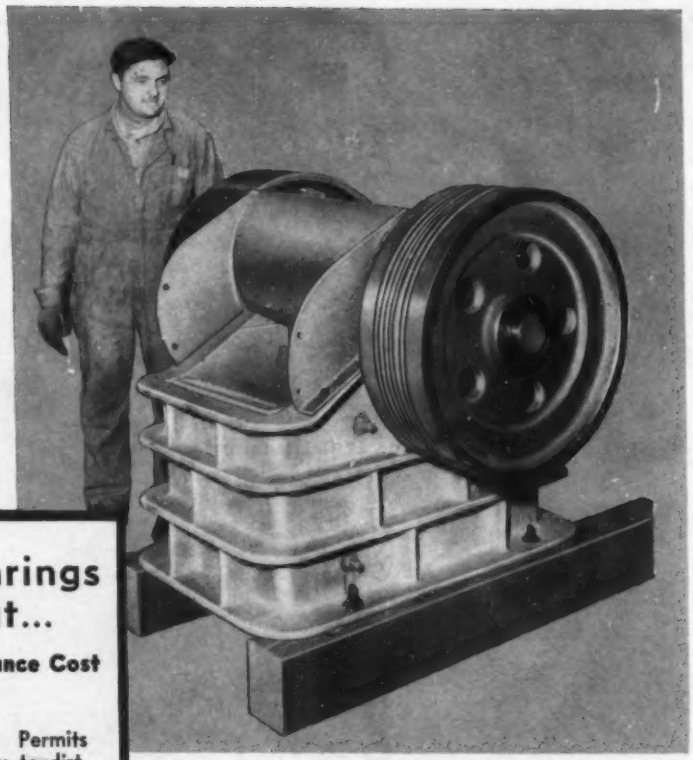
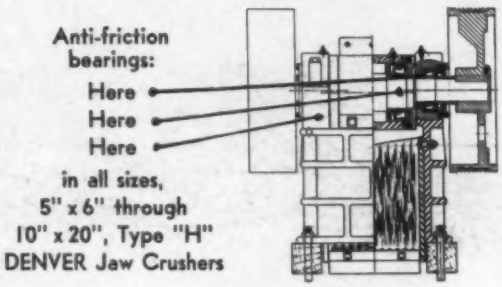
NEW! DENVER Forced Feed Jaw Crushers



NOW - Roller Bearings Throughout...

For Long Life—Low Maintenance Cost in Heavy Duty Operation

Side bearings are in a carrier . . . . Permits bumper removal without exposing bearings to dirt.



Anti-friction roller bearings in side frame as well as bumper. Means crusher runs cooler, bearings last longer, crusher gives longer service, cuts maintenance costs.

Side bearings (on 10" x 16" and 10" x 20") set in ball and socket type mounting for perfect self-alignment.

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Cast steel frame heavily reinforced to withstand more than the most severe service it will meet in its size reduction range. Cast iron toggle acts as safety device, breaks first in case tramp iron enters, prevents damage to other parts.

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Jaw and cheek plates made from 13% to 14% manganese steel. Jaw plates reversible for longer service, lower replacement and maintenance costs.

Find out how DENVER Jaw Crushers can help you with your size reduction problems. *Write, wire or phone today.*

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Mining World

THE IMPORTANT MINING MAGAZINE EVERYWHERE

September 1957

INTERNATIONAL PANORAMA

SANTA BARBARA, HONDURAS—Deep diamond drilling at the El Mochito lead-silver mine of the New York & Honduras Rosario Mining Company has indicated important ore reserves that may be greater than all ore developed to date.

KITWE, NORTHERN RHODESIA—A five-year program to increase copper output by 55 percent has been started by Mufulira Copper Mines, Limited. The Mulfulira West ore body will be brought into production at a cost of $39,200,000.

RECEFE, BRAZIL—Fosphorita Olinda has started its new 2,400-ton-per-day phosphate mine and mill here to become South America's largest phosphate producer.

LAKE ALBANEL, QUEBEC—Cleveland-Cliffs Iron Company's Canadian subsidiary, Canadian Cliffs, and M. J. O'Brien Ltd. have formed a new company called Albanel Minerals Ltd. to develop and operate extensive deposits of low-grade magnetite in northwestern Quebec.

SIPALAY, NEGROS OCCIDENTAL, PHILIPPINE ISLANDS—The Sipalay Copper Mining Company has made its first shipment, 2,400 tons, of copper concentrate to Japan from its new 4,000-ton flotation mill.

AMBROSIA LAKE, NEW MEXICO—Rare Metals Corporation of America has discovered uranium ore by deep drilling in Sect on 30, T. 13 N., R. 8 W. This is one of the most southeasterly discoveries in the district.

STEEP ROCK, ONTARIO—Steep Rock Iron Mines Limited has started construction work on a new heavy media separation plant for treatment of low-grade ore stripped from margins of main ore body during mining. The plan will start operating during 1958 shipping season.

MT. ISA, AUSTRALIA—Record annual lead and copper production for year ending June 30th was made by Mount Isa Mines Limited. Lead bullion output was 40,875 tons and blister copper was 26,335.

SAN FRANCISCO, CALIFORNIA—During the first six months of 1957 4,200 tons of U_3O_8 concentrates were produced in the United States from 1,620,000 tons of ore. Comparable 1956 figures are 2,600 tons of concentrate and 1,340,000 tons of ore.

MOSCOW, RUSSIA—Production of iron ore, pig iron, aluminum, lead, zinc, and molybdenum was increased during first six months of 1957 in comparison with similar 1956 output. Iron ore output was up to 41,300,000 tons.

CHRISTMAS ISLAND—A major expansion program is underway here to more than double phosphate rock output by 1961. Production goal is 800,000 annual tons; up from 350,000 in 1956.

WASHINGTON, NORTH CAROLINA—Bear Creek Mining Company is continuing its exploration drilling program to evaluate large low-grade phosphate deposits in Beaufort County. The Kennecott subsidiary seeks to lease 250,000 acres for exploration.

ESKER LAKE, QUEBEC—Union Carbide and Carbon Corporation's subsidiary, Dominion Mines and Quarries, will explore a 51-square-mile nickel copper concession in the Ungava nickel belt owned by Stupart Quebec Mines, Ltd.

BONANZA, UTAH—American Gilsonite Company has developed a new jet water mining method here and officially started shipments of crushed ore through its new 72-mile pipeline.

WELKOM, ORANGE FREE STATE—The No. 2 shaft of St. Helena Gold Mines Limited intersected the reef at a depth of 4,900 feet and cut 18 inches of ore assaying four ounces per ton. Drilling had indicated only low gold values in the area.

ASARCO Announces Major Arizona Copper Discovery

The American Smelting and Refining Company has announced a major copper discovery at its East Pima, Arizona properties. The company reports that indicated reserves are about twice the size of the company's Silver Bell copper mine in Arizona. Based on published figures, the East Pima reserves must now be about 65,000,000 tons of ore, assaying between 0.90 and 1.00 percent copper. Those for Silver Bell were 32,000,000 tons of 0.90 percent ore when mining started. Actually the Silver Bell ore averaged 0.93 percent copper for the first 6,219,000 tons mined from March 1, 1954 through July 1, 1956.

The East Pima area about 15 miles south of Tucson is where ASARCO recently paid $1,066,007.04 for mineral rights on three tracts totalling 15,000 acres of Papago Indian Reservation land. ASARCO has been exploring these tracts by surface drilling since its bid was accepted in May. ASARCO also controls mining claims south of the Indian Tracts and north of claims of the Pima Mining Company which is operating an open-pit mine and 4,000-ton-per-day flotation mill. It was in this area that ASARCO made its original discovery and has carried out a long program of diamond, churn, and rotary drilling from the surface.

Mufulira Plans 5-Year Copper Expansion Program

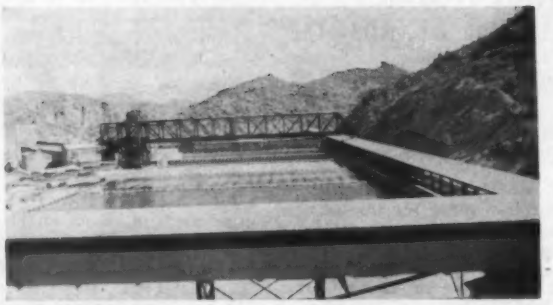
Mufulira Copper Mines, Ltd. plans to begin a $39,200,000 copper expansion program for the development of the company's west ore body in Mufulira, Northern Rhodesia despite the current drop in the price of copper. The program will take approximately five years to complete, and will increase the annual production from the present rate of 100,000 long tons a year to 155,000 long tons a year. That is an increase of 55 percent.

Additional plans were made for further development of Chambishi Mines, a subsidiary of Mufulira. This program calls for an annual production of 25,000 tons of copper.

Mufulira Copper Mines belongs to the Rhodesian Selection Trust, Ltd., a group of Northern Rhodesia copper producers in which American Metal Company, Ltd. holds a controlling interest. The Selection Trust Group have announced a 10 percent cut on the output of Roan Antelope Copper Mines and Chibuluma Mines, also members of the group, but it will have no effect on the proposed expansion of Mufulira.

Next Month—How Blast Furnace Yields Liquid Zinc End Lead Bullion

Dual Process Metallurgy Stretches Inspiration Ore Reserves



Why Dual Process of Leaching Followed by Flotation Was Installed. For Report Of New Mill See Page 55

By STANLEY DAYTON
Associate Editor

Once again metallurgy is pumping new life into the mines of Inspiration Consolidated Copper Company at Inspiration, Arizona where both copper sulphides and oxides have long been treated by leaching and electrolysis. Faced with the problems of mining lower grade ore containing an increasing proportion of sulphides, Inspiration took these steps:

- Abandoned the unique and classic, acid ferric-sulphate leaching practice which has become a textbook example of hydrometallurgical treatment of mixed oxide-sulphide copper ore.
- Switched the plant to the Dual Process which includes a straight acid leach to extract the copper oxide fraction from the ore, followed by flotation of the washed residue to recover the sulphide portion.
- Completely renovated an idle concentrator, equipping it with new machinery for treating 15,000 tons of minus-¾-inch residue to implement the flotation of the sulphides in the Dual Process scheme.

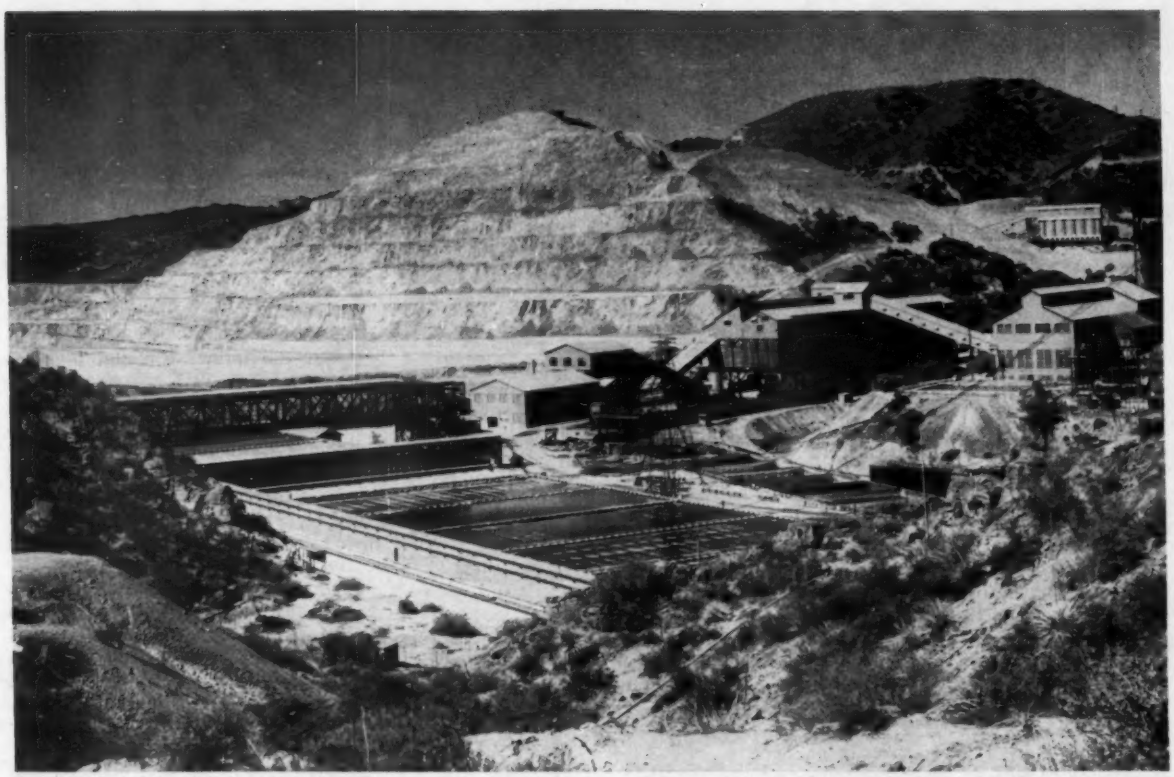
The Dual Process was put into operation early in January of this year at about two-thirds of rated capacity. Since then, treatment rates have been increased until the full rated capacity of 15,000 tons per day was reached during the week of April 22. All of the hydrometallurgical facilities are included in the Dual Process circuit. These consist of two acid plants, 13 percolation leaching tanks, cementation launders for stripping copper from wash solutions, and the electrolytic tank house for depositing cathode copper from pregnant, acid copper-sulphate solution.

Perhaps the most fundamental aspect involved was a $6,000,000 project for re-activating the old Inspiration concentrator, located a mile from the leaching plant. First built in 1915, the mill has been idle since 1930 with the exception of a brief period of operation in 1937 and during World War II. Though it wasn't as easy as it sounds, the new flotation plant was designed and installed under the old building using most of the existing floor levels. The design contractor was Headman, Ferguson, & Carollo, a firm in Phoenix, Arizona. The construction contractor was Western-Knapp Engineering Company. The mill design is outstanding and is discussed in some detail later in this report.

Some of the advantages which will accrue as a direct result of the changes are listed below.

Greater mining flexibility: The acid ferric sulphate process was developed so that copper ore which carried both oxides and sulphides could be successfully leached to extract the copper. For best efficiency, however, the method required a theoretical copper ratio of 40 percent sulphide and 60 percent oxide in the feed; and the mine had to govern the feed somewhere near the above ratio. With the Dual Process now in operation, the mine can work only to hold the grade of total copper at the cut-off point.

Expanded capacity: Now that flotation follows leaching, the solvent con-



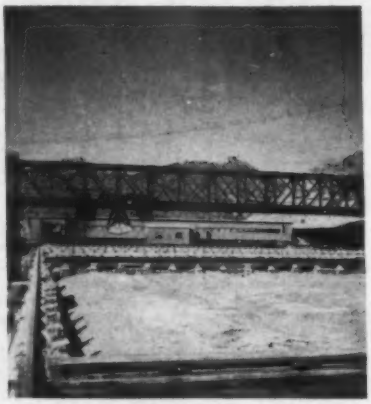
Leaching: Classic acid ferric sulphate treatment of Inspiration ore has been abandoned in favor of the Dual Process. The latter involves an acid leach to extract oxide copper with subsequent flotation of washed residue to recover sulphides. Above is the Thornton open pit with a portion of the leaching facilities in the foreground.

Flotation: Biggest factor involved in project was complete rehabilitation of Inspiration's idle concentrator. The mill is rated at 15,000 tons per day when operating with six of the seven ball mills. It is located about 1½ miles from the leach plant. The Dual Process expands Inspiration's capacity for copper output, improves recovery.

tact time is reduced from 9 days to 4 days. This is due to the fact that, in general, sulphides are attacked more slowly than oxides by acid and ferric sulphate. Consequently, a longer leach cycle was required for obtaining a satisfactory recovery. The 13 concrete, lead-lined, percolation leaching tanks at Inspiration could handle 10,000 tons of ore per day using the acid ferric sulphate method. But reduced contact time and adequate flotation capacity now make it possible to treat 15,000 tons of ore per day.

Greater recovery: Some copper sulphides, notably chalcopyrite, are relatively insoluble even in hot acid ferric sulphate solutions. Increasing amounts of chalcopyrite are being found at both the Thornton and Live Oak open pits of Inspiration. Treatment of ore containing this mineral couldn't be postponed indefinitely. Under the Dual Process, chalcopyrite is recovered by flotation at the concentrator.

Additional capacity for refined copper: The change in plant practice will release a large portion of the existing capacity of the electrolytic tank house since the major share of the sulphides will not enter the solution for electro-deposition. Current efficiency at the tank house also will benefit because of the reduced concentration of ferrous ions in the electrolyte; ferrous ions oxidize during electrolysis, and exert considerable corrosion influence at the lead anodes. The excess electrolytic capacity will be used for refining anode copper produced by smelting, on a toll basis, of concentrate made at the rehabilitated mill. The refined copper would only require casting into commercial shapes to be ready for market.



DUAL PROCESS results in expanded leaching capacity since solvent contact time can be reduced from 9 to 4 days.

Adds to ore reserves: Nearly everyone is faced with the problem of mining lower grade ore and Inspiration was no exception. To maintain production at 10,000 tons per day, Inspiration would eventually have needed additional leaching capacity to obtain equivalent copper output under the ferric sulphate leach. The Dual Process and mill rehabilitation provided the logical answer to this problem and added treatment flexibility.

Any one of the above factors would have justified the change to the Dual Process. On top of this the characteristic of the ore was changing toward a higher proportion of sulphides in the feed. Whereas the ferric sulphate process was established on a 60 to 40 ratio of oxides to sulphides, future ore reserves contain copper in just the reverse ratio. The new facilities are designed to treat the mixed ore of the latter ratio. Using a straight acid leach, no more than 20 percent or more of the sulphide copper is recovered by leaching with the mill scavenging the remainder by flotation.

Relieves an iron balance problem: Under the former leaching practice, ferric sulphate was required to dissolve copper sulphides. Since the Inspiration ore is low in iron content, facilities were provided for introducing iron in the circuit to make up for loss of iron to tailings. Spent electrolyte, of course, is used to cover fresh ore at the leach plant. To provide the necessary make-up iron, some of the wash solutions, containing insufficient copper for electrolysis, were cycled to a cementation plant. Copper was stripped from solution by iron which went into solution. A definite amount of cement copper had to be made in order to preserve the iron balance for ferric sulphate leaching. At best, manipulation of solution volumes was very ticklish and required close and precise control. The more sulphides in the feed, the more ferric sulphate was required. With future reserves tending toward a higher proportion of sulphide copper, an increasing proportion of cement copper would have to be made in order to maintain the iron balance. It was a strange paradox, but soluble copper was required for ultimate formation of the solvent. To continue the ferric sulphate leaching

TRAINS are powered by General Electric, 500-horsepower, Diesel-electric locomotives. About 36, eight car train loads per day keep the mill running at capacity.

CARRIAGE on excavating bridge suspends a 17-ton capacity Wellman-Seaver-Morgan clamshell. Washed residue is hauled to the mill by Pressed Steel cars and G. E. locomotive.

process would have resulted in a never ending circle with increased demands being made on the iron launders; at the same time the copper output directly obtainable from the leach circuit would shrink in direct proportion.

The leaching plant, the acid plant, and the electrolytic tank house have been well described[1] so these facilities will only be dwelt on briefly here. The accompanying flowsheet was typical of product flow under the ferric sulphate leaching practice which has been abandoned. It shouldn't be assumed that the same thing holds true today. It is shown only to illustrate the facilities that are available for leaching and electrolysis. The leaching cycle and the washing cycle have been changed to meet the requirements of a straight acid leach. Insufficient data has been accumulated on the operation under the Dual Process to make more than a few general comments.

Crushing remains the same: Run of mine ore delivered to the storage bins serving the leach plant has been reduced to minus-1-inch size. This feed is first fed to a ¼-inch screen to scalp out the fines for separate treatment. This portion contains naturally occurring colloidal slimes produced by weathering at the pit which would interfere with solution penetration during percolation leaching. Three Dorr rake classifiers make a sand-slime separation of the minus-¼-inch fraction. The sands re-enter the feed to the leach plant. The slimes, containing 85 percent minus-200-mesh, are treated separately by methods just the reverse of the Dual Process. First the slimes are sent to the mill where the sulphide content is removed by flotation roughing and single-stage cleaning. The flotation tailing is then leached in three agitators in series containing wooden cross arms and lead rakes. The residue is washed by four counter current thickeners. Pregnant solution made from the slime portion is passed over a set of iron launders to precipitate cement copper. This slime circuit is entirely separate from the main treatment facilities. Approximately seven percent of the feed to the crushing plant reports to the slime treatment circuit.

Size characteristics of the feed to the percolation leach plant are given in the accompanying table.

Each of the thirteen leaching vats measure 175 feet by 67.5 feet by 19.5 feet deep. They are constructed of concrete and lined with 7-pound chemical lead. The lining is protected against sagging by a timber curtain consisting of a series of vertical timber posts and horizontal 2-inch planking. The posts are butted into the floor of the tank and snubbed against the inside wall of the tank. The filter bottom consists of 2-inch planking drilled with 15, ⅜-inch holes per square foot. The filter floor is protected by 4- by 6-inch timbers extending parallel to the long dimension of the tank and laid on 4-foot centers. This protects the filter floor from the action of the clamshell bucket used to excavate a tank once the leaching and washing cycle has been completed. Final clean-up of alternating rows is by hand.

The tanks are arranged in a single row so that one loading bridge and one excavating bridge which travel the length of the row will serve the plant. Both of these bridges span the long dimension of the tanks. The loading bridge contains a Hewitt Robins conveyor with an automatically reversing tripper which beds the ore in a tank. At each reversal of the tripper, the entire loading bridge moves forward 2½ feet until it reaches the end of the tank when the motion is reversed. In this manner the charge is introduced to a tank in a series of beds approximately three feet thick.

Entry of solutions to individual tanks is through a 14-inch, antimonial lead pipe with ½-inch thick walls. This pipe is joined to the tank just above the concrete bottom of the tank and below the filter floor. The concrete

Dual Process: Rebirth Of An Old Idea

Again Inspiration Consolidated Copper Company has turned the corner and is embarking on a new era. Metallurgically, this famous porphyry copper has had a varied and rich background. It has had the vision to pioneer and utilize unique processes when required.

For instance, Inspiration built the first concentrator in the United States using the flotation process as the major method of recovery. It went into operation in 1915. This mill was originally designed to produce a gravity concentrate, but, while it was still in the construction stage, great forward strides were being taken in the development of the art of flotation. So exciting were these developments that Inspiration halted construction work on the concentrator for a year. The staff, engaged in research, designed a unit similar to the Callow cell and proceeded to equip the mill for flotation. This was a radical step in those days and required a great deal of faith and courage. At the time, sulphide ore was being mined underground.

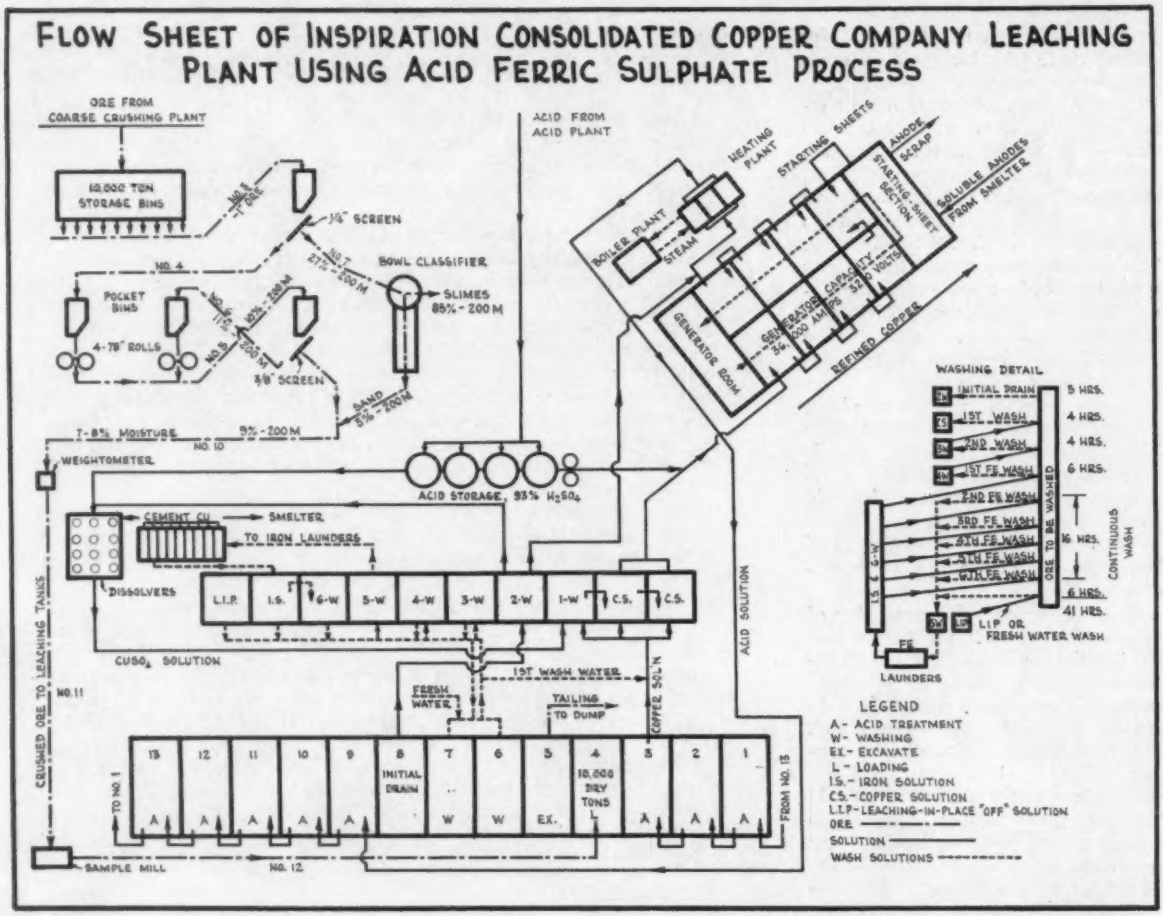
After a few years, the oxide ratio of the ore began to increase. Something had to be done about treating this ore to obtain a satisfactory recovery. A group of metallurgists headed by Dr. Louis Ricketts developed the acid ferric sulphate process which was capable of leaching most sulphides as well as the oxides. A plant was built and put into operation in 1926 using this process. And to this day the plant remained unique.

It is significant that at the time the plant was built, consideration was given to the Dual Process treatment. Today, 31 years later, the Dual Process has been adopted. In the intervening time, underground operations have been shut down. Ore is now mined from two open pits—the Thornton and Live Oak. Each time the metallurgy changed, new life was added to the Inspiration ore deposits. And once again ore reserves have been extended—this time by the adoption of the Dual Process.

Screen Analysis of Feed to Percolation Leaching Plant Inspiration Consolidated Copper Company

Screen Size	*Percent*	*Cumulative Percent*
Plus 3 mesh	9.9	
" 4 "	16.0	25.9
" 6 "	13.9	
" 8 "	11.1	
" 10 "	8.5	
" 14 "	7.0	
" 20 "	5.7	72.1
" 28 "	4.2	
" 35 "	3.5	
" 48 "	2.8	
" 65 "	2.3	
" 100 "	1.9	
" 150 "	1.4	88.1
" 200 "	0.9	
Minus 200 mesh	10.9	
TOTALS	100	99.9

[1] H. W. Aldrich and W. G. Scott, *The Inspiration Leaching Plant*, Transactions AIME, Volume 106.



FLOWSHEET shown above illustrates leaching and washing details of the acid ferric sulphate process formerly used at Inspiration. The straight acid leach now in use has shortened the cycle and relieved an iron balance problem.

bottom of each tank slopes toward the center and toward the end wall where the pipe joins. Both drainage and solution entry take place through this pipe. To arrange the tanks in series, an overflow launder is provided at the opposite end of the tank from the solution entry side. These launders are connected with the suction side of the pump for the adjoining tank. This is how solution flow from tank to tank is obtained. Provision is also made in the launders to return the overflow to the feed pump so that solution can be circulated on itself for specified periods of time. A series of 10 holding tanks, also lead-lined, are used to store pregnant solution, and the various wash solutions.

The iron launders shown in the flowsheet formerly were important in preserving the necessary iron balance for the abandoned ferric sulphate leach. At the present time they are used primarily to strip copper from low-grade wash water. The off-solution from these launders is now discarded.

In 1951 the dissolver section was added to the cementation circuit so that precipitated copper could be recovered electrolytically. The dissolvers were especially designed to provide intense agitation under extremely oxidizing conditions. These requirements were necessary in order to dissolve metallic copper with sulphuric acid. Each of the 12 dissolvers contains a rotor identical to those used for Fagergren flotation machines. The agitator tank measures 6 feet in diameter by 7 feet high, but only the bottom 3 feet of each tank is actually used in taking cement copper into solution. The agitator is loaded with a small charge of copper and then covered with enough acid to fill the lower 3 feet of the tank. A frother is added and agitation commences. A deep froth column is produced extending from the pulp level to the top of the agitator. The froth column is an effective barrier for holding precipitated oxygen in the bath, and slows the escape of gas, thereby providing the necessary oxidant for the reaction.

The copper sulphate solution produced by the dissolvers goes to the electrolytic tank house along with pregnant solution obtained by leaching the ore.

It requires approximately 200,000 gallons of solution to cover a bedded charge or about 11,000 gallons per foot of tank depth above the filter bottom. Solution percolates upward through a fresh charge of ore displacing the 7.5 percent moisture content which overflows to the launder system. During washing, displacement of one wash by another follows a flat plane through the ore in the tank.

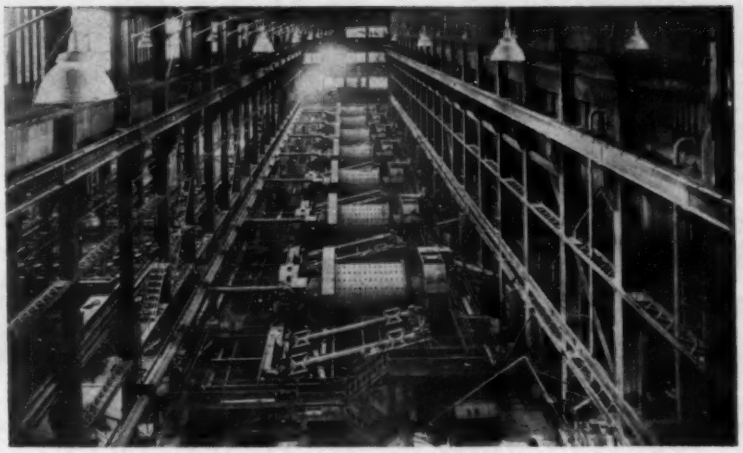
The tank house contains 120 cells arranged in a horseshoe circuit. Each cell measures 33 feet long by 4 feet

wide by 4 feet 3 inches deep. Also included is a starter sheet section of 20 cells for making cathode starters from fire refined copper. Both acid and ferric sulphate are regenerated during electro-deposition of copper from solution. Formerly it was desired to maintain the ferric iron content at 9 to 10 grams per liter in the spent electrolyte. Under the present operation it is desired to hold the concentration of ferric iron below four grams per liter.

The leaching and electrolytic facilities are now operating in substantially the same manner, but, of course, the leaching and washing cycles are completely different. Under the four day leaching cycle now employed, from 60 to 80 percent of the sulphide copper remains in the feed to be recovered by flotation.

A tank which has completed the leaching and washing cycle is allowed to drain for approximately five hours before the charge is excavated. The leach residue which is the feed to the flotation plant is removed by means of a 17.5-ton-capacity, clamshell bucket suspended from the excavating bridge spanning the row of leaching tanks. The carriage for the clamshell travels back and forth on the bridge excavating the leached charge and dumping the contents in Pressed Steel, bottom dump, 50-ton-capacity cars on a standard-gauge rail spur adjacent to the tanks. The trains are made up of eight cars which are hauled by General Electric, 500-horsepower, Diesel-electric locomotives. The clamshell makes three passes to load a car. Approximately 36 train loads are excavated from the tanks each day. Excavating is done on three shifts.

The standard gauge railroad leading to the mill, located one mile from the leaching plant, involves a slight down-grade haul for a distance of 7200 feet to the mill bins. The fine ore bin at the Inspiration mill is a 300-foot-long, suspended catenary type providing a total storage capacity of 15,300 tons or about 51 tons per running foot of bin-length. The catenary construction provides excellent facilities for direct unloading of the bottom dump cars in the trains within the length of the grinding bay and without resorting to high storage silos which would require conveyor loading. Vertical steel divider curtains in the bin divide it into 18 compartments of approximately 850 tons each. The track trestle spans the length of the catenary ore bin and is long enough to provide tail room for the train at the side opposite the entry.



INSPIRATION'S RE-FITTED MILL contains seven 10½- by 14-foot Allis Chalmers ball mills and seven Dorr, 16-by 38-foot, HX classifiers. One unit serves as a spare. Note provision for Akins spiral return of classifier sands.

Rehabilitated Mill Recovers Sulphides From Leached Ore

The new milling installation is housed within the framework of the original mill building which was completed back in 1915. Equipment locations were governed by existing structural members which was a complicating factor in layout and design. Little work was required on the building itself with the exception of a new roof. Of course, new walkways were required. Design contractor for the mill project was a firm from Phoenix, Arizona—Headman, Ferguson and Carollo. The construction contractor was Western-Knapp Engineering Company.

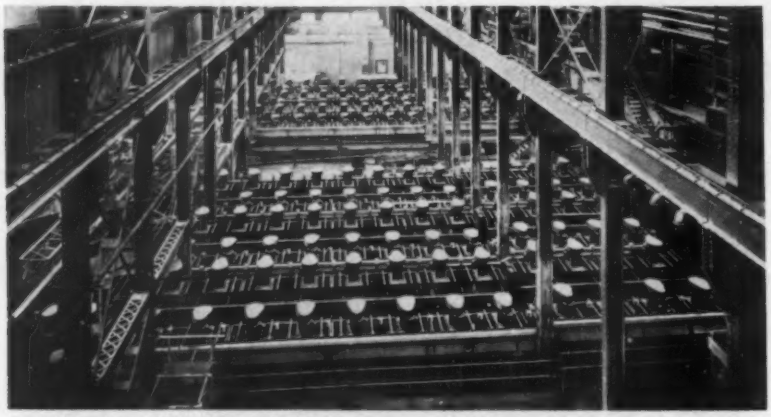
There are many unusual features in the concentrator. The layout and design including location of equipment is impressive. A quick summary of some of the more outstanding aspects include:

1. Provision for a 2,500-ton-daily test circuit within the 15,000-ton capacity concentrator.
2. A simple flowsheet.
3. Use of washed air ventilation for the electric sub-station located in the mill building.
4. Centralized location of push button stations and control consoles.

All these highlights and several others are covered in some detail in the report to follow. The basic building was typical of early day mill construction, and consisted of four bays or decks of stepped arrangement on a hillside. This allows gravity flow of the products and reduces the pumping requirements.

Scavenging the sulphide portion from the mixed oxide-sulphide ore, previously leached, has one primary advantage. The ore is quite clean, consisting predominantly of chalcocite with minor quantities of chalcopyrite, and very little pyrite. Leaching removes the oxides, and helps scour the surface of the sulphides by removing traces of oxidation products. The feed has already been deslimed by mechanical classifiers before it enters the leach plant. In many respects the ore has been ideally conditioned for the concentrator. Though the leach residue delivered to the mill contains a small amount of residual acid, lime consumption has not been excessive. Natural pH of the product fed to the mill is about 3.0; about 5 to 6 pounds of lime has been required per ton of ore to neutralize and maintain the desired alkalinity (pH 9.5) for flotation. Incoming feed from the leach plant has a moisture content of 9.5 to 10.5 percent.

The flowsheet is simple and straight forward. Grinding is carried out in six, Allis Chalmers, 10½ by 14-foot ball mills in closed circuit with Dorr rake-type classifiers. A seventh ball mill-classifier unit has been installed as a



ROUGHER FLOTATION CIRCUIT is composed of 12 rows of 12 Wemco Fagergren, 66-inch flotation machines. Piping and launder design includes a provision for isolating one grinding unit, two flotation roughers, and one cleaner for test purposes.

spare. Classifier overflow at 33 percent solids is floated in 12 rows of 12 Fagergren 66-inch flotation machines using Z-6 and pine oil. Each of the 12 parallel banks of flotation machines makes a rougher concentrate only. The rougher concentrate undergoes single-stage cleaning in four parallel rows of Fagergren cleaners. These four rows contain five cells and a fifth row, the test cleaners, contains four cells. The middling, taken from the tail end of the cleaner cells, is returned to the head of the rougher circuit. The cleaned concentrate is thickened in two 60-foot-diameter thickeners and filtered on an Eimco, 8-disc, 6-foot-diameter filter. Mill tailing, taken from the rougher tailing, is partially classified and thickened in two, Dorr, 32-foot-diameter hydroseparators. The hydroseparator overflow is sumped in a 38- by 27-foot concrete reservoir and pumped to two, 275-foot-diameter, Dorr traction thickeners located above the mill. Thickener location was dictated by the lack of space at the mill site below the building. Though solids must be pumped under a dynamic head of 105 feet to the thickener, the location offers the advantage of providing for gravity flow of reclaimed water to the mill reservoir. Thickened underflow from the traction thickeners and from the two hydroseparators join and flow to the tailing area through 18-inch Transite pipe. Use of hydroseparators aids in maintaining a higher solids content in the material discharged to tailing.

Test circuit: This feature is particularly worthy of special attention. The Inspiration concentrator contains a provision for a pilot plant within the commercial circuit. Piping, distributor, and launder design make it possible to completely isolate from the remainder of the concentrator one of the seven ball mill-classifier circuits, along with two rows of the 12 flotation roughers and the test cleaner circuit. Since the mill does not contain a re-grind circuit, the advantage of this arrangement becomes apparent at once. Testing of reagents, feed rates, and recirculation schemes can be carried out on a commercial scale of 2,500 tons per day. The test work will not be hampered by the usual problems of feed-back of recycled products from outside the test circuit—a problem which makes results difficult or impossible to evaluate within the framework of the testing procedure.

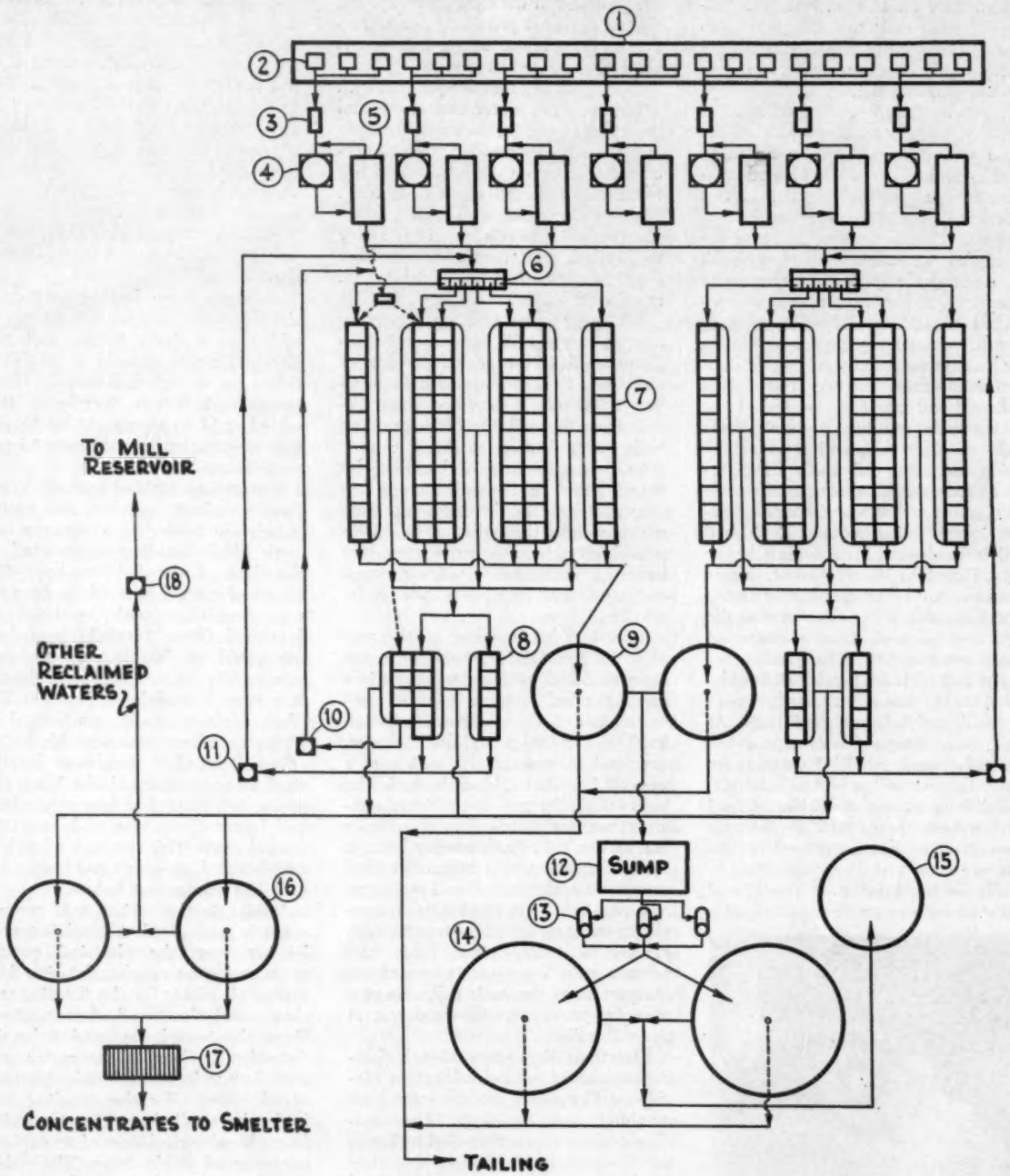
Belt feeders draw from fine ore bin: Bottom-draw-off feeders below the suspended steel catenary bin utilize short 60-inch-wide endless conveyor belts running on pulleys spaced on 5-foot centers. Belt feeders were chosen over pan or apron feeders due to an anticipated longer life expectancy. It was felt that the combination of residual acid content of the ore delivered from the leaching plant together with abrasive action of ore on apron and pan feeders would lead to excessive wear and corrosion. A wide variety of makes and types of belts are being tried on this service. Most belts are 4-ply with either rayon or nylon fabric; in one instance a combination rayon-nylon fabric is being tried. Manufacturers represented include B. F. Goodrich, Raybestos Manhattan, Goodyear, and Hewitt-Robins.

The bottom of the suspended catenary fine ore bin was modified by attaching 21 inverted pyramidal draw-off sections to feed the belts. This modification increases the drawability from the bin and increased the live load. The draw-off sections are lined

INSTRUMENTATION mounted at each classifier includes a Transweigh tonnage recorder (right) for ball mill feed and a Honeywell pH recorder (left) for classifier overflow.

CONCENTRATOR SUPERINTENDENT, Kenneth L. Power, was able to observe re-fitting of mill from the start. Building housing the new installation was completed in 1915.

Flowsheet Inspiration Consolidated Copper Company Mill



1. 15,300-ton capacity, steel, catenary fine ore bin.
2. 21 belt feeders, 60 inches wide.
3. Transweigh belt scales.
4. 7 Allis Chalmers 10½- by 14-foot ball mills; six in service, one standby.
5. 7 Dorr HX, 16- by 38-foot classifiers.
6. Galigher sampler and pulp distributors; three in the circuit, one for test section.
7. 12 banks of 12-cell, Fagergren, 66-inch flotation machines, roughers.
8. 4 banks of 5-cell and 1 bank of 4-cell, Fagergren 66-inch flotation machines, cleaners.
9. 2 Dorr, 32-foot diameter hydroseparators.
10. 1 Hazelton, 3-inch, twin-volute pump; test cleaner tails.
11. 6 Hazelton, 5-inch, twin-volute pumps; cleaner tails; two in service, four standby.
12. Concrete sump, 36- by 25- by 16-feet deep.
13. 3 Hazelton, 12-inch, centrifugal pumps; two in service, one standby.
14. 2 Dorr, 275-foot traction thickeners.
15. 1,500,000-gallon capacity mill reservoir; mill head tank.
16. 2 Dorr, 60-foot diameter, concentrate thickeners.
17. Eimco, 8 disc, 6-foot diameter thickener.
18. 1 Hazelton, 8-inch, twin-volute pump.

with ½-inch AR steel plate. Each ball mill is served by three belt feeders which load an 18-inch collector conveyor; the collector conveyor discharges to a 24-inch belt feeding the ball mill. The ore is weighed in transit on the ball mill belt by a Transweigh belt scale. Each conveyor scale is coupled to a remote recorder at the sand end of the classifier; an automatic pH recorder is also located adjacent to the tonnage recorder at this station.

Spare grinding unit: Designed capacity of the mill is given as 15,000 tons per day with six grinding units operating. A seventh ball mill was installed to add flexibility in capacity and to provide for regular shutdown for maintenance and servicing without curtailing daily output. The fourth ball mill and classifier, located at the center of the grinding bay, with three mills on each side, will serve as the swing unit. The ball mills are 10½- by 14-foot Allis Chalmers units driven by 1,000-horsepower, General Electric, synchronous motors. Each ball mill is in closed circuit with a heavy duty, Dorr HX, 16- by 38-foot, duplex classifier. An Akins spiral is mounted at right angles to the rake arms at the sand end of each Dorr classifier to return oversize to the ball mill.

The ball mills are lined with double-wave Cr-Mo liners, and charged with Sheffield molybdenum-steel balls. At the present time the only size added is 2-inch-diameter balls. Lubricant for the bevel gear on the ball mill drive is added from a pressurized Farval feed gun permanently mounted on the gear housing. Lubricant is sprayed on the gear once each shift by operating a handle on the lubricator. The Farval gun contains a recorder consisting of a punch actuated by lubricant pressure and a clock-driven paper card. Holes are punched in the card each time the unit is operated providing a true record of lubrication. Crater 2X fluid is used in the Farval reservoir.

CONTROL CONSOLE monitors Fagergren (Wemco) flotation machines. Signal light goes out when a machine is down.

Each grinding unit is equipped with a Beckman pH meter and Honeywell recorder. Piping for an automatic lime valve has been provided from the recorder station on each classifier but to-date controllers haven't been tried. The pH electrodes are inserted in the classifier pool; lime is added as a slurry to the ball mill feed end. Classifier overflow is held at a pH of 9.5 as mentioned earlier.

Charging balls: At the present time approximately 1.25 pounds of 2-inch-diameter balls are added per ton of mill feed. Bulk storage of balls totalling 1,200 tons is provided about ¼-mile from the mill. Once the grinding balls are unloaded at this bin they require a minimum of handling by hand. Gates on the ball storage bin empty to a Toledo batching scale which weighs the balls out in 3,000-pound charges. Discharge from the batching scale to a waiting truck equipped with a special bed is by gravity.

The steel haulage box on the rear of a 12 ton GMC Diesel truck has been modified by installing partitions across the bed dividing it into 6 compartments. Each compartment will hold one 3,000-pound ball charge, and each is emptied by means of a gate on the right side of the bed. The balls are discharged to a series of concrete bunkers installed at the upper end of the mill. Each bunker holds a charge for a separate ball mill and is connected with the ball mill by means of a pipe line. The bunker itself actually contains three compartments, each holding a 3,000-pound load, and when a gate is opened in one of the compartments the balls roll, one at a time, by gravity, to the feed box at the ball mill.

Flotation: Fagergren 66-inch flotation machines, made by Western Machinery Company, are used for both roughing and cleaning. These machines all contain a threaded socket in the drive shaft housing so that they can be equipped for air-control. Feed to the rougher section is introduced through two rectangular pulp distributors after first being sampled by a Galigher, Geary-Jennings unit located just ahead of each distributor. A third distributor was included in the piping design so that the test section, previously mentioned, could be isolated from the remainder of the roughing and cleaning circuit.

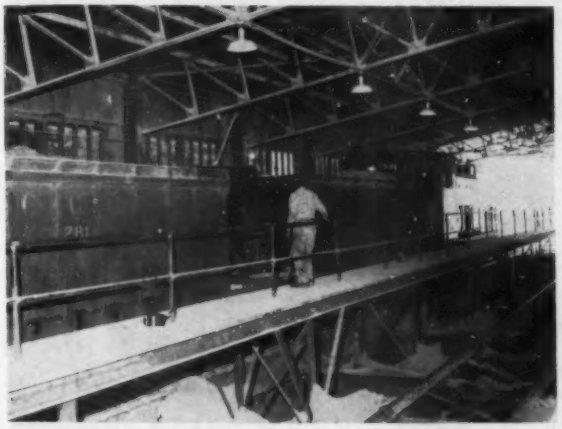
Reagents: Bulk storage and mixing facilities are housed in a small building adjacent to the mill. The collector, Z-6, is prepared for addition as a 10 percent solution by agitation in a small Pachuca unit. Provision is made to add the collector from Clarkson reagent feeders at either the ball mill feed end or to the classifier overflow. Undiluted pine oil is added to the classifier overflow; two pipe lines are carried to the various frother stock drums on the classifier walkways. This was done so that different types of frothers can be led to the same station for addition to the circuit.

Facilities have been provided for slaking crude lime so that it can be added as a slurry to the ball mill. Crude lime is ground in Hardinge 6-foot by 48-inch ball mills in closed circuit with 6-inch Dorrclones. It is added at 17 to 18 percent solids; particle size in the lime slurry is 85 percent minus-200-mesh.

Electric wiring and control: Transformers, relays, switches, and control panels are located in a separate concrete block building constructed on the floor of the flotation bay. This electrical control center is under positive ventilation with scrubbed air furnished from a Buffalo limit load fan rated at 50,000 cubic-feet-per-minute. On the suction end of the fan is a type B Buffalo air washer. The block building itself, constructed of 12-inch, hollow concrete blocks, is afforded excellent insulation by the dead air space in the blocks. What this means is a more dust free atmosphere and better dissipation of heat in the control room. This should lead to better electrical efficiency and longer life with less equipment failure.

Wiring to the various mill components is centralized. A conduit tunnel leading from the electrical control room under the rougher flotation floor carries all wiring for the flotation machines and the two hydroseparators. From the tunnel the conduit breaks through the floor at the motor and push button location thus limiting exposed wiring. For the grinding and feeder bays, all the wiring is carried from the electrical control room in a minimum of cable trays. The cable trays carry the only exposed wiring in the mill except for short break throughs from the electric tunnel.

Centralized push button stations and control consoles for starting equipment are located at convenient positions in the mill. Control consoles contain signal lights which monitor the equipment. If a machine fails, the light goes out and warns the operator. Push button stations are equipped



UNLOADING TERMINAL at mill spans a 15,300-ton capacity, suspended, steel catenary bin which is 300 feet long. The Diesel-electric trains travel over standard gauge track.

LOAD PUMPED to tailing thickeners is reduced by placing two Dorr 32-foot diameter hydroseparators in the circuit. Two Fagergren cleaners are shown in front of hydroseparator.

with a simple device to lock the unit in an off position. This is an obvious safety factor when a machine is down for maintenance. With the off-lock in position, it is impossible for an operator to walk by and start the machine while a repairman is at work.

Pumping reduced to a minimum: The sloping character of the mill building takes advantage of the force of gravity for flow of products. Though this was typical of mill construction several years ago before pumps were developed to the present high state of efficiency, it isn't so common today. Nevertheless, this construction and the simple flow-sheet have reduced the pumping requirements at the Inspiration mill.

Only two products require pump service. One is the middling which is taken from the tail end of the flotation cleaners and returned to the head of the rougher circuit. A Hazelton, vertical, twin-volute pump, rated at 325 gallons per minute, is mounted on the cleaner tailing sump to recycle the middling.

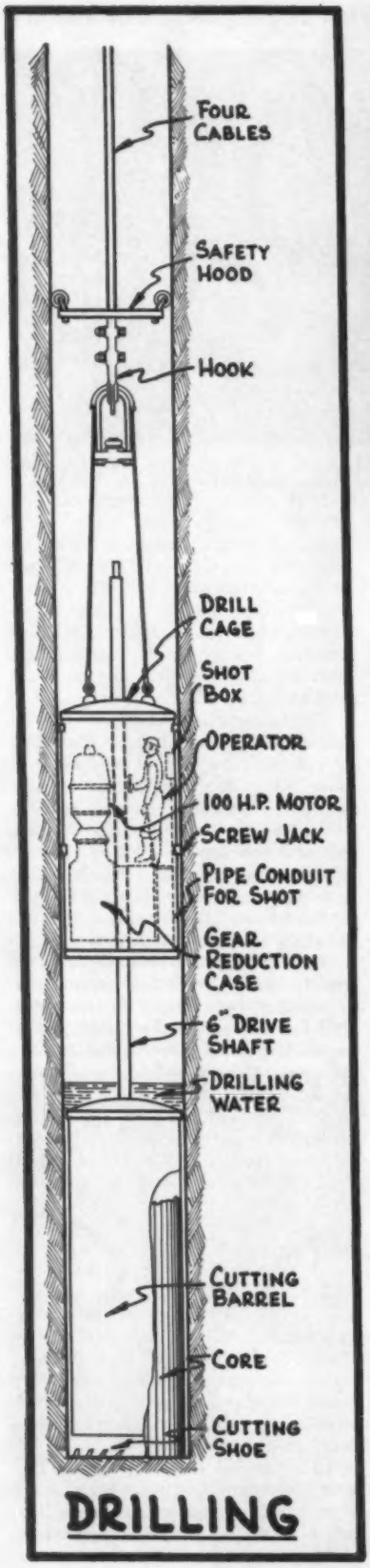
The other product requiring pump service is the mill tailing and this presented more of a problem because of the necessity for locating the tailing thickeners above the mill. Rougher tailing, which is the mill tailing, flows to two 32-foot-diameter hydroseparators which partially de-water the tailings. These hydroseparators were placed in the tailing line to reduce the load which must be pumped to the tailings thickeners, and also to boost the solids content of the pump discharge to the pond. The latter is a feature which makes water reclamation at the mill more efficient. The hydroseparators produce an underflow of 58 percent solids. But the overflow containing 25 percent solids must be thickened. The overflow from the hydroseparators flows by gravity to a large concrete sump measuring 36 by 25 feet at the top by 16 feet deep (inside dimensions). Serving this sump are three Hazelton, 12-inch, centrifugal pumps driven by 250-horsepower, Allis Chalmers motors. These pumps operate under a dynamic head of 105 feet and discharge the hydroseparator overflow to the 275-foot Dorr traction thickeners. Two of the centrifugals operate at fixed speeds and the third contains a variable speed drive. Normally one fixed-speed and one variable-speed pump handle the entire load. Tailing is delivered to the thickeners through 20-inch Transite pipe.

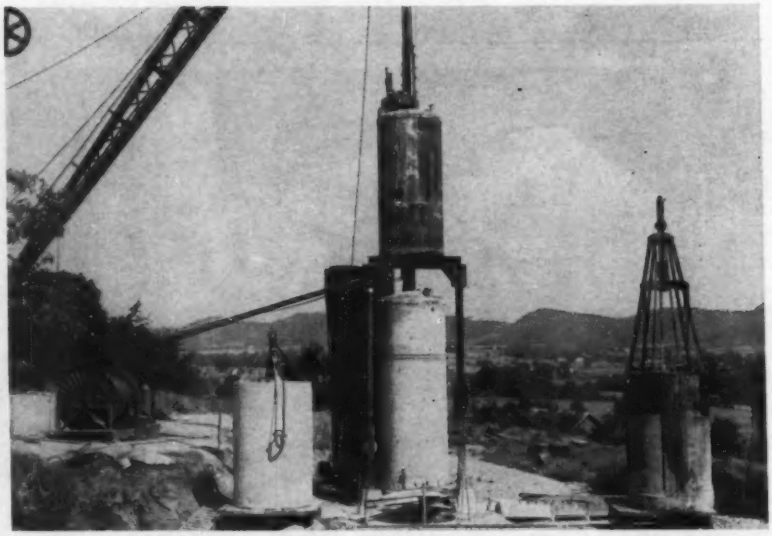
The thickeners were constructed partially on solid ground and partially on fill material. The bottoms of the thickeners were gunited and the center pier was installed on bedrock. A tunnel enters the fill and branches to the spigot of the two thickeners. The thickened underflow (48 to 50 percent solids) returns down the hill through an 18-inch Transite pipe line to the mill where it enters a concrete-lined steel launder system. Thickened underflow from the hydroseparators joins this launder which again empties into an 18-inch Transite pipe for gravity flow at 50 to 54 percent solids to the tailing pond.

Tailings disposal: The Inspiration mill tailing area was patterned after the Morenci method of disposal with certain modifications. It provides a ready means of reclaiming water from the pond, but the primary advantage is the reduction in moves required for the distribution system. The disposal area takes the shape of a horseshoe encompassing 105 acres which is enclosed by a berm. The two tips of the horseshoe butt against another old tailings dam approximately 100 feet high on the up-slope side of the hill. A level Transite pipe line, 18 inches in diameter, rests on top of the tailing berm and completely rings the disposal area. This pipe line serves as the main manifold for discharge lines.

The tailing line is brought down the hillside from the mill through a series of concrete drop boxes. On the up-slope side of the disposal area it splits into two branches and the flow to either branch can be controlled by valves. Each branch is led to the end of the manifold pipe through a 35-foot-high drop box. Thus tailing can be introduced to either side of the distribution system on top of the berm.

A series of valve-controlled 3-inch outlets, spaced on 26-foot centers, are installed at right angles to the manifold line and dump the tailing in the pond. The outlet valve is immediatelv adjacent to the manifold and is connected with the discharge line by means of a flexible hose. The berm around the pond will be raised as necessary by using bulldozers and a drag-line to scrape dried tailing to the inside edge of the distribution line. The berm will be raised in 5-foot increments as necessary. During this build-up it will not be necessary to raise the distribution system. Instead, additional lengths of 3-inch pipe will be attached to the end of the discharge outlets so that they can be sloped upward and over the new berm. The main, 18-inch manifold will remain on a bench surrounding the dam. In this manner it is hoped to build a dam 25 feet higher than the now horizontal distribution line. Eventually, of course, the main line will have to be elevated, but moves will be very infrequent.





HERE'S WHAT it takes to drill a 66-inch-diameter hole. From left are the stiff legged derrick (headframe); power cable reel; bailer; drill cage on top of platform; cutting barrel under cage; and core puller. Collar is in front of cutting barrel.

American Zinc Revives Old

Deeper mines, increased Dieselization using higher horsepower engines, and more tons per shift are the underground mining trends of today. These are fine trends, too, because they make possible mining of lower grade deposits, but they have necessitated better ventilation and circulation of greater volumes of air to the working faces.

The best way to get better ventilation is to increase the number of air ways from the surface to the mining areas. This is not simply or easily accomplished because air shafts of any kind cost money.

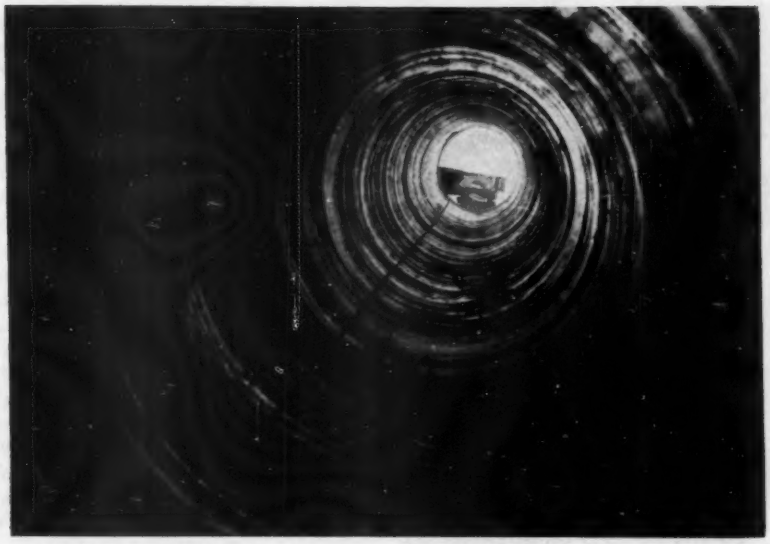
The American Zinc Company of Tennessee in planning its Young mine at New Market, Tennessee knew that seven Allis-Chalmers HD 6 Diesel-powered tractors would be necessary for initial production with "Gismo" loading and haulage. Adequate ventilation was essential so plans were made to sink a ventilation shaft simultaneously with the driving of a long haulage level from the Howard production shaft.

After complete engineering studies were made it was determined that the best way to sink the shaft was to drill it from the surface. To achieve this it was necessary to resurrect the science of drilling large diameter shot hole or Calyx holes.

While Calyx holes were used for a number of years by the Anaconda Company at Butte, Montana, their use has declined in recent years. However, the Colorado Plateau uranium boom witnessed their return to popularity for cheap access to relatively shallow, flat lying, small tonnage deposits. Consolidated Uranium Mines, Inc. developed a number of small mines through 36-inch Calyx holes in Utah's Temple Mountain

A 36-inch hole was too small to serve the needs of the Young mine so American Zinc's chief mining engineer, Charles A. Dobbel, turned back mining history to 1936 when the Idaho Maryland Mines Corporation, with equipment invented by J. B. Newsom, drilled a 60-inch-diameter shot hole 1,125 feet deep at its Brunswick mine at Grass Valley, California. Subsequently, the equipment was rebuilt, enlarged, improvements made, and Mr. Newsom and key shaft men drilled a 1,200-foot-deep hole in 1937 and 1938 at the Zenith mine of Pickands Mather & Co. at Ely, Minnesota. After this hole was completed, the equipment was moved to the company's Cary mine at Hurley, Wisconsin where it was used to drill a 2,600-foot ventilation shaft in 1943.

After the shaft was completed at Hurley all the drilling equipment from cutting shoe to stiff leg derrick was disassembled and stacked in a pile in the mine yard. It was still there late



FROM THE BOTTOM UP. This is the way the 66-inch-diameter ventilation shaft looks at American Zinc Company of Tennessee's Young mine. Circular rings cut in rock show clearly. The crown block at end of stiff legged derrick also shows.

Art To Drill 66-inch Hole

in 1956 when the progressive minded president of American Zinc, Howard I. Young, made arrangements for the purchase of this equipment and it was shipped to New Market, Tennessee.

Jack Gilbert, with a wide background of mine and mill construction and operation for American Zinc, was assigned the job of drilling the Young ventilation shaft. No one in Tennessee had ever seen the drill, and for that matter only a few in the United States. The equipment from Wisconsin was trucked to the site and assembled. Some parts were missing, new ones had to be made, and yet the drill was started in mid-June. Hoists and other equipment were moved from nearby American Zinc mines. New power cable, hoisting cables, and air hose were purchased.

The three-man erection crew is now being trained to operate the drill. One is permanently a hoist man, while two drillers alternate in the hole and on the surface every two hours.

Nine Drill Components

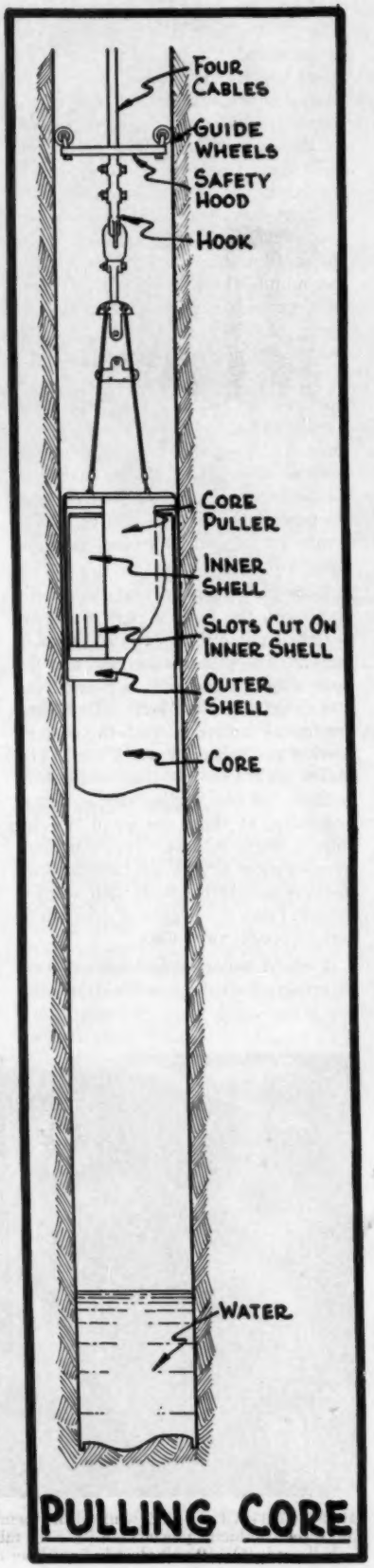
For those readers too young to remember the Brunswick shaft job and those readers who may have forgotten how the drill operated, a study of the accompanying photographs which show the key parts will illustrate how the drill operates. The key parts are: 1. Cutting barrel. 2. Drill cage. 3. Core puller. 4. Bailer. 5. Stiff legged derrick. 6. Traveling safety hood. 7. Main hoist. 8. Man hoist. 9. Power cable reel.

Auxiliary equipment includes a 125-cubic-foot, electric-driven compressor to supply air through hose to bottom of hole; a swinging bailer discharge trough at the hole collar; a 7½-horsepower, double-drum, electric-driven hoist used to swing the derrick boom back and forth over the collar; a Bogen intercommunication system between hoist house and drill cage; and welding equipment, etc. A Davis inhalator with oxygen tanks and mask is available for emergency use if air supply is cut off to hole's bottom.

Here Are Drill Components

Cutting barrel is 66 inches in diameter and 15 feet long. A mild steel cutting shoe or ring 18 inches high and 1½ inches wide is welded to the bottom of the barrel. In this ring a series of 8-inch-long shot notches are cut at an angle of 45° at 16-inch intervals. As this ring wears away, additional rings are welded to the bottom and new shot notches burned out.

The **drill cage** is mounted above the cutting barrel and directly connected to it by a 6-inch-diameter steel driving shaft. Both units are simultane-



ously lowered to the bottom of the hole by the main hoist; the drill cage is anchored in place by a series of hand operated screw jacks which fasten into the rock; and the cutting barrel is rotated by the electric motor in the cage. This obviates the long drill stem from bit to surface drive mechanism normally used for rotary drilling. A 100-horsepower motor mounted vertically in the cage rotates the cutting barrel at 52 revolutions per minute through a series of reduction gears. This gives a peripheral speed of 853 feet per minute at the outer edge of the cutting ring.

There is room in the cage for the operator to stand. The cage also houses the supply of cutting shot, an ammeter, and the control wheel to position the cutting barrel; that is, to advance, or lower, the barrel as it deepens its kerf below the cage. The entire cutting unit is 30 feet long and weighs about 15 tons.

Core puller has an inner and outer shell with the bottom part of the inner shell cut into a series of strips or fingers. The puller is lowered into the hole after drilling unit is hoisted out and drops down the kerf. The fingers are forced inward to grab the core as tension is applied by main hoist. The puller and core are then hoisted to surface. In the earlier shafts it was necessary, at times, to shoot off the core or break it loose. This was done by dropping a stick of powder into the kerf and setting it off with a timed primer. Later a wedge was driven into kerf to break core loose.

A round **bailer** 10 feet high is used to removed drilling water from the hole with the main hoist. It has a conventional inlet-discharge valve on the bottom. It is filled and then hoisted several feet above the collar; a swinging trough fastened into the concrete collar is swung under bailer which is then lowered to open the bottom valve allowing water to discharge through the trough down hillside.

A **stiff leg derrick** with a 60-foot steel boom is used as the headframe. Its base is 35 feet from the center of the hole. The derrick has the advantage of being easily taken apart for use over other holes. It is set so far back of the hole that there are no legs to interfere with equipment and movement around collar as would be the case with a headframe; the boom can be easily swung back and forth to pick up equipment stored around collar and to quickly set aside core for disposal. Twin 48-inch steel sheaves for main hoist and an 18-inch sheave for man hoist are mounted at top of boom.

A travelling **safety hood** is used over drilling unit, core puller, and bailer. This hood has two sheave wheels and the large hook. It is comparable to the travelling block on an oil drilling rig. The safety hood, 62 inches in diameter, has three rubber-tired guide wheels which roll against the wall of the hole. This hood is permanently attached to the main hoist. The three main hole making units are alternately attached to it.

The **main hoist** is set 100 feet back of the hole's center. It is a 200-horsepower Vulcan-Denver unit with an eight-foot-diameter, single drum holding 4,500 feet of 1-inch nonrotating cable. The cable is rigged through the travelling hook and twin sheaves to make a four fall line for a hoisting speed of 70 feet per minute. Thirty-ton loads are hoisted with ease.

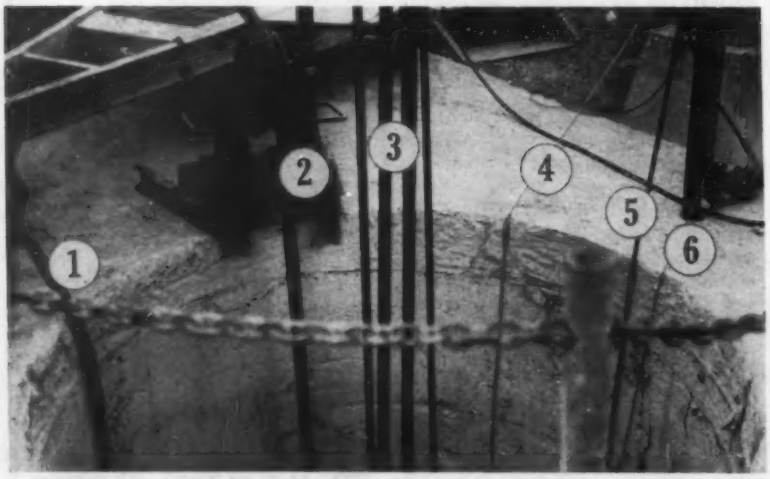
The **man hoist** is a single-drum, four-foot-diameter unit with a ¾-inch nonrotating cable. It is used for hoisting and lowering men and small supplies.

A motor-driven **cable reel** is used to lower and hoist the three-conductor, rubber covered, 440-volt power cable which supplies electricity to the driving motor in the drill cage. This cable weighs three pounds per foot so mechanical handling is a necessity. The cable is lowered into the hole over a movable sheave wheel mounted on the collar.

Typical Cycle

A complete cycle starts by lowering the drill cage and cutting barrel to the bottom of the hole. Water is poured into the shaft until it is five feet deep. Then one-half sack of bentonite is poured into hole to make drilling mud and prevent cementing of drill barrel if rotation is stopped for any length of time. Next the boom is swung over the drilling unit which is sitting on its platform to the left of the collar (all directions are given as the hoist operator sees them). The hook is lowered into position by the main hoist. The drill man gets into the bucket and is hoisted to the eye of the drill cage by the man hoist. He threads the hook through the eye, sets the safety lock, and is lowered to the ground. The drill unit is now lifted up off the platform by the main hoist; then the derrick boom is swung to the right by an auxiliary, double-drum, swing hoist located 75 feet from the collar with cables leading to the crown block. The drilling unit is centered over the collar and then lowered to the bottom by the main hoist.

Next the bell signal cord is lowered into the hole. Then the drill operator gets into the bucket and is lowered by man hoist to the top of the drilling unit. As the unit is lowered into the hole, a steel cable ladder is hung from the top safety hood to the top of the drill cage. The operator gets out of the bucket onto the safety hood, rings the bucket away and waits for the air hose, electric intercommunication line, 110-volt electric light line, and 440-volt power cable to be low-



SHAFT SERVICE LINES while drill operates are: (1) compressed air hose; (2) 440-volt, three-conductor power line; (3) Four fall 1- inch nonrotating hoist cable; (4) Hand bell cord; (5) 110-volt electric light line; and (6) Bogen intercommunication line.

ered into the hole. He guides each through the hood to the drill cage, connects the power line, and descends the ladder into the cage.

The operator plumbs the cage and fastens it securely in place by advancing the nine screw jacks into the walls. He engages the drive shaft to the motor drive through the control wheel and starts the bit rotating. Shot is fed from the box to the bottom of the hole at the rate of 50 pounds per hour by the operator. A mixture of G 10 grit and 5/32-inch round chilled steel shot is used for cutting. The operator watches the ammeter in the cage to judge how the bit is cutting. When the amperage raises the cutting is slow; shot is added which usually reduces the load on the motor. Blocked kerf or broken core also makes the amperage rise.

The drilling cycle continues until core breaks off or has been cut to optimum depth for the ground at that point. The operator shuts down the drill, unscrews the jacks, disengages the lines, which are hoisted to the surface, and then is hoisted to the surface himself. The cutting unit is hoisted out of the hole, swung over and lowered on the platform, and the main hook disengaged in reverse sequence to going into the hole.

The main hook is swung (right) over core puller, lowered, and engaged. It is then lifted by hoist, centered over hole, and dropped to the bottom. If the kerf is clear, it settles over the core and as tension is applied by main hoist the fingers of the inner barrel tighten on the core. At the first three holes it was necessary to blast the core loose by dropping powder into the kerf or wedge it free. To date the near surface rock at the Young mine has broken free.

When the core breaks up, it is necessary to bail the water out of the hole with main hoist and go down and muck out the broken core using the man hoist and bucket.

After the loaded core puller is hoisted out of the shaft, it is swung to the right and lowered onto a flat car. Core lifter is blocked free of core, lifter hoisted away and set down. Car is run out on dump and core knocked off over dump.

Hole is bailed and the bottom is checked. Any core not pulled in lifter is hand mucked and hoisted to surface.

The cycle is then repeated.

Shattering of the core in the near surface broken rock has been the greatest problem to date. The hole is being drilled along side an exploration diamond drill hole so the rock condition is known from the log. More homogeneous rock was reached in late July and a seven foot long core was pulled with ease.

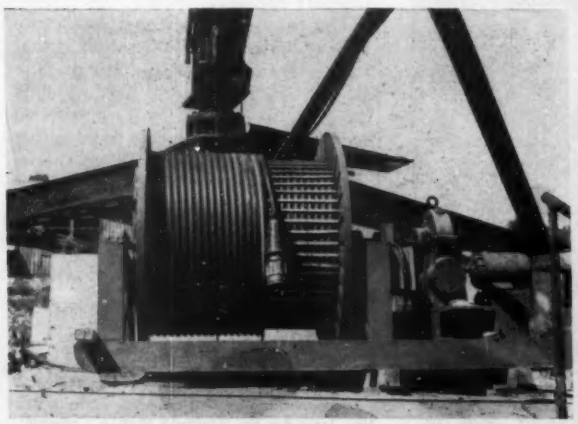
What About Water

The first three holes were all drilled from the surface into existing mine workings which had completely dewatered the area. This may not be the case at the Young mine where the main haulage level is being driven 2,400 feet to reach the air shaft. A heavy inflow of water was encountered in a fault near the shaft. The heading, now about 450 feet from the shaft, makes a small amount of water. No one knows whether it will drain the drill hole area. If not, there are several dewatering alternatives including drilling an 8-inch churn drill hole a few feet from the drill shaft and dewatering the area with a deep well pump in the churn drill hole. Another alternate would be to diamond drill from the shaft and grout a solid plug through which to drill the shaft.

JACK GILBERT, has supervised the shaft project since equipment was shipped to Tennessee from Wisconsin.

More Shafts Needed

American Zinc has revived an old art. The long unused equipment has been overhauled and placed in operation, and men are being trained to drill the shaft. There is an immediate need and unlimitless future for many low-cost ventilation shafts. American Zinc is in a strategic position with equipment and, most importantly, relearned know-how.



CABLE REEL at foot of the stiff legged derrick. This reel is driven by an electric motor to speed handling of heavy cable. The derrick pivots around joint shown above reel.

DRILL CAGE at collar of hole. Arrow points to one of the jacks which are screwed into the solid rock to prevent the cage from turning in hole as bit rotates.

BRETZ MILL CINNABAR flotation circuit of Arentz-Comstock Mining Venture in Malheur County, Oregon. Plus-90-percent cinnabar recoveries are made in this new mill. Concentrates are furnaced in a Herreshoff plant to produce elemental mercury.

BOTTLE CREEK MILL rougher flotation circuit of Triangle Mining Company in the Bottle Creek mining district north of Winnemucca, Nevada. Concentration ratios up to 200-to-1 are achieved by dispersing pulp with Palcotan and one-stage cleaning.

UNITED MERCURY FLOATED cinnabar at its mill in Pershing quicksilver district south of Lovelock, Nevada. Excellent results were reported while the mill was in operation using No. 18 Denver flotation machines.

Nevada Mills

By Keith Kunze

A new concept in mercury flotation has been developed in Nevada and Oregon which holds promise for the eventual low-cost treatment of large tonnages of very low-grade cinnabar deposits.

Extensive laboratory pilot plant testing, followed by commercial-scale application at three flotation mills, has proven that flotation is a useful recovery tool for certain types of ores. Also that information on mercury flotation in the technical literature has been erroneous. This latter fact undoubtedly has been a detriment to the operator who tried to follow "the book" for floating cinnabar.

When the Arentz-Comstock Mining Venture started its 150-ton-per-day cinnabar flotation mill at the Bretz Mine in Malheur County, Oregon, in November 1956, it became the third new operation in the Nevada-Oregon district to utilize flotation concentration for the recovery of cinnabar. The first cinnabar flotation plant in the district was the 125-ton-per-day mill built by Triangle Mining Company in the Bottle Creek district, 70 miles north of Winnemucca, Nevada. This was followed by the United Mercury Company's 125-ton-per-day mill built in the Pershine quicksilver district, about 12 miles south of Lovelock, Nevada.

Where "The Book" Was Wrong

Cinnabar (HgS) floats readily, and flotation tests have been made on mercury ores for many years by many investigators . . . but, in spite of this, flotation has until recently made very little inroad on the historic method of mercury recovery.

One of the factors that has probably militated against flotation is that sometime in the past the use of soda ash and sodium silicate as dispersion reagents for cinnabar ore has been written into the literature on cinnabar flotation.[1] Recent test work has shown that both these reagents are strong *depressants* for cinnabar, and their use will result in poor recoveries.

Various dispersion reagents were tried during the test work that pre-

[1] Taggart's *Handbook of Mineral Dressing.*

Mr. Kunze is general superintendent for Getchell Mine, Inc. at Golconda, Nevada. His interest in mercury flotation started two years ago when he was asked to make flotation tests for the Triangle Mining Company. Since that time he has made hundreds of tests on many types of ores. Photographs in this article were taken by Don Tibbals.

Rewrite Cinnabar Flotation Textbook

ceded the construction of the three plants herein discussed. All of these plants mill soft, clay-like ores, and at times dispersion is necessary for best results. Palcotan (a Pacific Lumber Company lignin product made from redwood bark) proved to be the best of numerous dispersion reagents tried.

Cinnabar oxidizes rapidly on exposure to air, so for best flotation results it is necessary to activate the surface-oxidized crystals with a heavy metal salt. Lead nitrate, lead acetate, and copper sulphate have been used successfully for this purpose. As all three of these reagents affect the frothing characteristics differently on various ores, it is necessary to establish, by test work, which reagent should be used on any particular ore.

Flowsheets of the Bottle Creek, United Mercury, and Bretz mills are given.

A consolidation of the reagent practice at all three mills is shown in the table.

The successful application of this recovery method in a field that heretofore has been the exclusive domain of furnaces bids well to add a new concept to mercury mining and metallurgy.

Mercury mining has been dependent on a recovery method little changed in the last 2,000 years. Furnacing which depends as it does on the treatment of high-grade ore for its efficiency has been one of the factors that has limited mercury mining to highgrade, small tonnage operations. (For a number of years the largest producer of mercury in the United States was a 90-ton-a-day plant.) Other factors that effect mercury mining are those over which the miner has little influence, i.e., markets, ore deposits, etc., but an improvement in the metallurgy of mercury is something that many people feel is long overdue.

All test work on these ores indicated best flotation densities of 20 to 30 percent solids. The pH range of the flotation circuits at all three mills is from 6.0 to 8.0, but pH control does not appear critical. The usual pH regulators—lime, soda ash, and sodium silicate—are all detrimental to cinnabar flotation and should not be used.

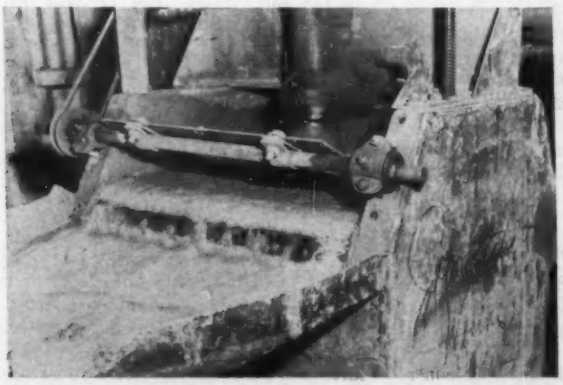
Recoveries of plus-90-percent into a 30 to 50 percent Hg concentrate are reported by all three operations. Following flotation, the highgrade concentrate is retorted.

A study of plant costs made at the Arentz-Comstock operation show a lower capital investment for the flotation plant over a comparable size furnace installation, with operating costs expected to be about equal. Advantages of a flotation plant over a furnace installation are:

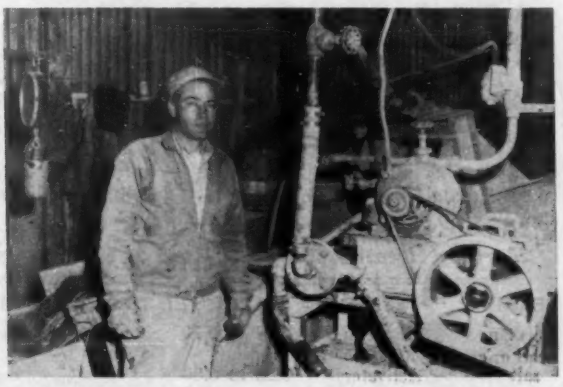
1. Greater flexibility on tonnage.
2. Better recoveries on certain low

OPEN-PIT BRETZ mine supplies ore for Arentz Comstock. Wells Cargo Company contracts mining and trucking operations. A Northwest Diesel shovel and ore trucks can be seen in pit.

GRINDING AND CLASSIFYING circuit at Bretz mill. Samuel Arentz, head of the operation, reports that Palcotan, a dispersant, helps classification as well as flotation of sticky ore.



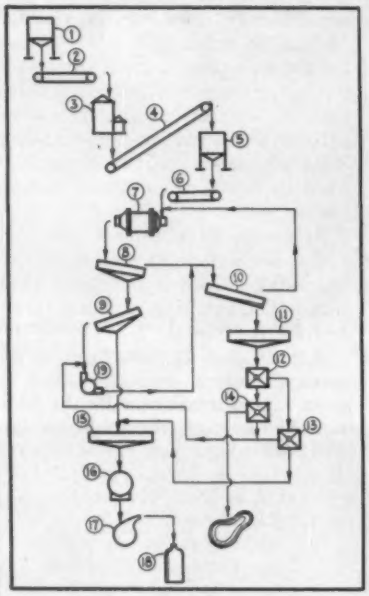
BRIGHT RED cinnabar concentrate makes a vivid contrast with white froth in the Denver No. 18 cleaner cell at the Bottle Creek mill of Triangle Mining Company.



CINNABAR FLOTATION research has been led by Harry Trollope, vice president of Triangle Mining, pictured here, and John Etchart, company president. Jig recovers coarse cinnabar.

Mercury Flotation Flowsheets

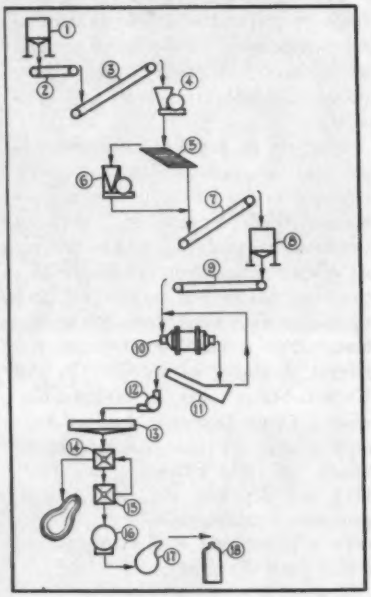
Bottle Creek, Nevada Mill
Triangle Mining Company



LEGEND

1. Crude ore bin.
2. Pan feeder.
3. Hammer mill.
4. Belt conveyor, 14-inch.
5. Fine ore bin.
6. Belt feeder.
7. Denver ball mill, 4- by 4-foot.
8. Denver mineral jig, 20-inch.
9. Wilfley sand table.
10. Denver rake classifier.
11. Conditioner, 36-inch Fagergren.
12. Rougher flotation, four 36-inch Fagergren.
13. Cleaner flotation, one No. 18 Denver.
14. Scavenger flotation, two No. 18 Denver.
15. Settling tank.
16. Eimco filter.
17. Retort.
18. Bottles.
19. Pump.

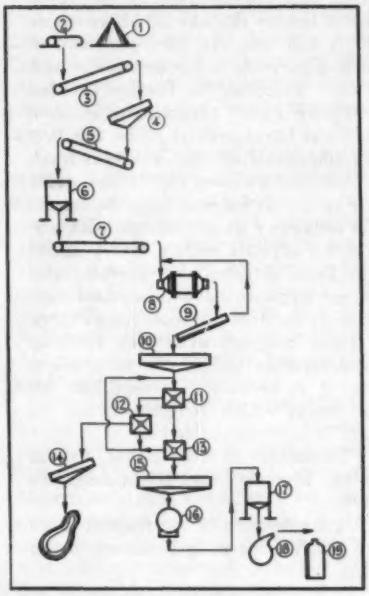
Pershing County, Neveda Mill
United Mercury Company



LEGEND

1. Two 200-ton coarse ore bins.
2. Two feeders.
3. Belt conveyor.
4. Jaw crusher, 10- by 20-inch.
5. Grizzly.
6. Cone crusher, 30-inch Traylor.
7. Belt conveyor.
8. Two fine ore bins, one 150-ton steel, one 100-ton wood.
9. Two feeders.
10. Ball mill, 5- by 5-foot.
11. Screw classifier, 36-inch Wemco.
12. Sand pump, SRL.
13. Denver conditioner, 4- by 4-foot.
14. Rougher flotation, five No. 18 special Denver.
15. Cleaner flotation, one No. 18 special Denver.
16. Pan filter.
17. Retort.
18. Bottles.

Bretz Mill, Malheur County, Oregon
Arentz-Comstock Mining Venture



LEGEND

1. Stock pile.
2. Slusher.
3. Belt conveyor.
4. Vibrating screen, 4- by 8-foot Allis-Chalmers.
5. Belt conveyor.
6. Fine ore bin.
7. Belt feeder, 20-inch.
8. Ball mill, 5- by 5-foot.
9. Rake classifier, duplex.
10. Conditioner, 5- by 5-foot.
11. Rougher flotation, three No. 18 special Denver.
12. Scavanger flotation, two No. 18 special Denver.
13. Cleaner flotation, one No. 18 special Denver.
14. Pilot table.
15. Thickener, 12-foot Denver.
16. Eimco leaf filter.
17. Concentrate bin.
18. Retorts.
19. Bottles.

grade and/or wet or dusty ore.

3. Less health hazards.

4. Better resale market for type equipment used.

Some disadvantages are:

1. More complex flowsheet.
2. Water supply problems.
3. Fine grinding necessary.

The Bretz ore is soft; most of it is mined from lake bed sediments while some cinnabar has been recovered from silicified tuffs and other volcanic rocks. Triangle ore is found in andesite close to intrusive dikes. Several furnace plants have operated successfully in the district. United Mercury ore is found in limestone. This type ore, too, has been successfully furnaced.

In general, flotation plants have their most obvious application treating soft, very wet ores, and would have an increasing advantage in low-grade, large tonnage operations. Direct furnacing is more ideally suited to treating hard opalite type ores, and in high-grade, small tonnage operations.

Mercury Flotation Reagents Used at Nevada and Oregon Mills

REAGENT →	USED FOR ➤	POUNDS PER TON ORE →	ADDED TO
Palcotan	Dispersant	0.04 to 0.10	Ball mill
Lead or copper salt	Activator	0.20 to 0.50	Ball mill and conditioner
Reagent 301	Promoter	0.20 to 0.50	Conditioner
Frother 65	Frother	As needed	Flotation cells

Preconcentrate By Flotation

Flotation, as an adjunct to existing furnace plants, appears promising, particularly where dust or wet ore problems exist. Flotation could also be used as an economic method of increasing the capacity of existing furnace installations by screening the fines out for flotation and roasting only the coarse ore.

The writer respectfully acknowledges assistance for this article to the following: John Etchart and Harry Trollope of the Triangle Mining Company; James Fyfe, Al Taylor, and James Goldsworthy of the United Mercury Company; Samuel Arentz, Roy Hickman, and Paul Sorenson of the Arentz-Comstock Mining Venture; and Edward Buchanan and Don Tiballs of the Getchell Mine, Inc.

THE END.

Cannon Concentrator Separates Heavy Minerals from Beach Sands

Union Carbide Ore Company is installing the new Cannon Circular Concentrator on its rebuilt, connected, bucket-line gold dredge at Fernandina Beach, Florida to recover heavy minerals from fine beach sands.

The Cannon is the first film type gravity concentrator that can be installed on the same dredge hull as the digging unit and successfully concentrate all sand at full digging capacity.

Figure No. 1 shows schematically one of the concentrator's 48 segments in operation. Conditions for optimum

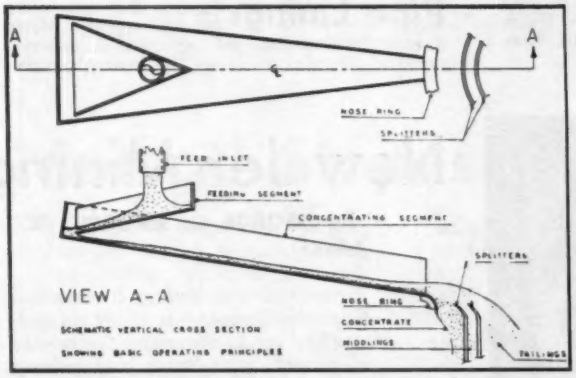


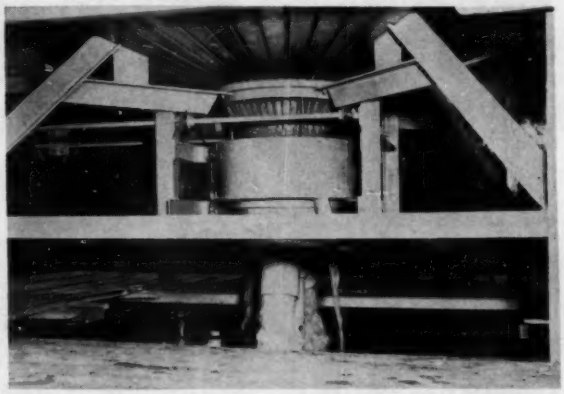
Figure No. 1. One of 48 segments in the Cannon concentrator.

stratification are obtained through tranquil gravity flow of a shallow film of relatively high density pulp or slurry (50 to 60 percent solids) down the convergent concentrating segment, or launder. After they flow over the curved discharge lip, or nose ring, the strata are split into three components, concentrate, middling, and tailing, by the streamlined splitter blades. (See Picture No. 1.) The concentric splitter blades are adjustable. Separation and high recovery of heavy minerals has been especially noteworthy in the finer size range. The high concentration ratio required by low-grade ores is achieved by three stages of counter current recirculation.

There are only two operating adjustments on the concentrator; the two splitters. Vertical adjustment of these splitters is done by turning the control handles. Pulp density control is centralized in the main feed sump where either electronic or manual control may be applied. No wash water is required.

Operating units have required practically no maintenance as wearing points are either padded with rubber or made of molded rubber to minimize wear. The feeding and concentrating segments are made of molybdenum bearing stainless steel.

The Cannon Concentrator's high capacity per unit of weight and per unit of space make possible great savings in both installation and operating costs. The following table gives capacities and dimensions for the standard unit shown in Picture No. 2.



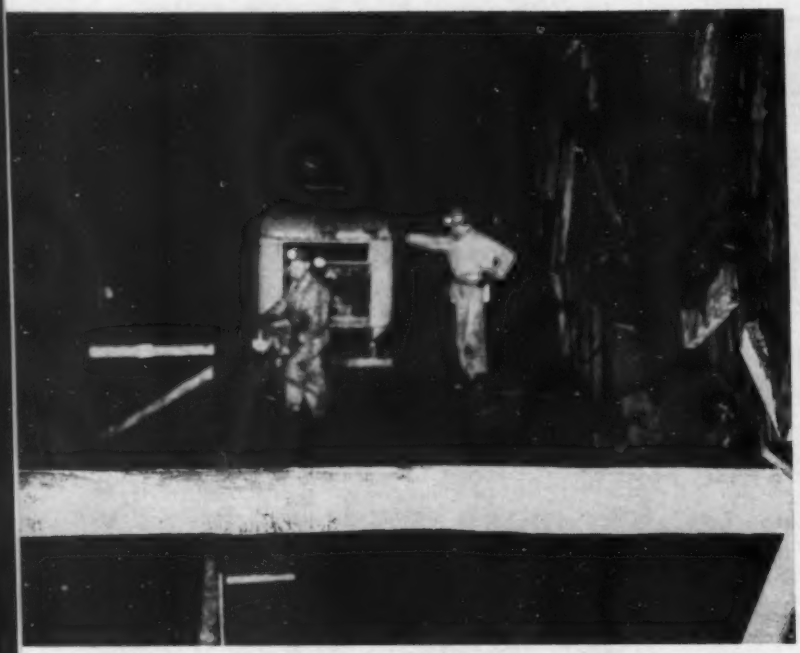
Picture No. 2. View of standard concentrator in operation.

Picture No. 1. Concentrator makes three products.

CANNON CIRCULAR CONCENTRATOR

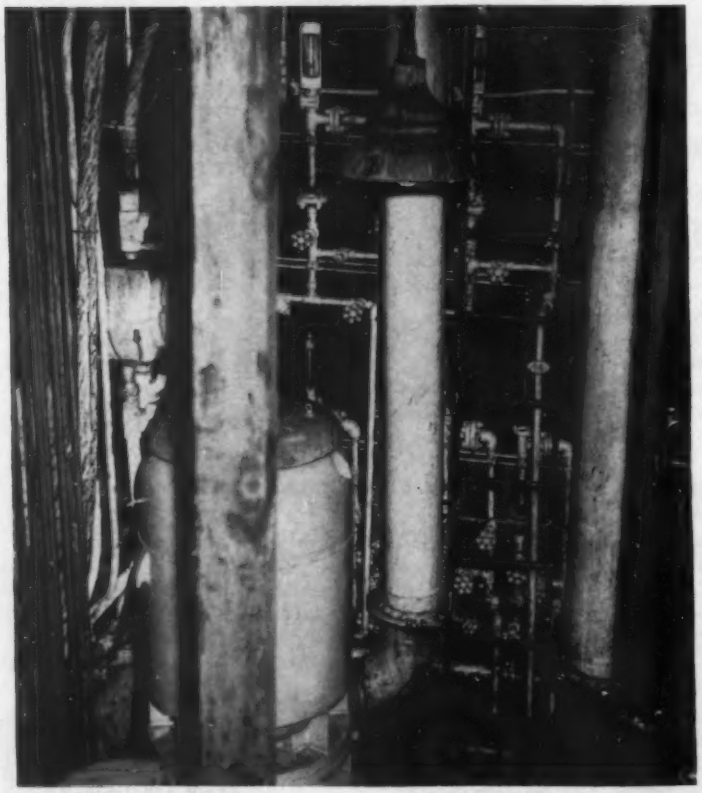
Total feed capacity per circular unit (In terms of dry solids)	30 to 50 tons per hour
New feed capacity per circular unit (Based on full, three-stage, counter-current recirculating for a low-grade sand)	15 to 30 tons per hour
Dimensions of unit	
Outside diameter	7 feet 1 inch
Height	6 feet 0 inch
Weight	About 1,000 pounds
Operating load per unit	About 200 pounds

Harry B. Cannon of Lakeland, Florida perfected and has patented the concentrator.



Mining: Hydraulic jet mining machine in center of 16-foot-wide Gilsonite vein. Trench shows behind machine down which broken ore is sluiced. In foreground a stull shows between walls. Note headboards and roof bolts in right wall.

Pipe Lining: Laying the 6-inch 72 Gilsonite - water slurry line at 2,000 pounds per square inch pressure. speed of 3.0 miles per hour. This is first long dis-



Pumping: Crushed and sized ore is collected in a 140-foot sump at the bottom of the E3 shaft. Two Barrett Haentjens deep well pumps pick this ore up and pump it to five centrifugal station pumps connected in series which boost it on to surface at 350 pounds per square inch pressure.

New Jet Mining

By GEORGE O. ARGALL, JR.
Editor

Any way you look at it American Gilsonite Company is doing an outstanding job in advancing the science of mining, pipe lining, and refining at its Gilsonite mines and new refinery at Bonanza, Utah, and Gilsonite, Colorado, respectively.

Gilsonite is the solid hydrocarbon ore used to produce high octane gasoline and high purity metallurgical coke. Gilsonite is the first ore ever to be mined as a commercial source of gasoline.

Take a look at these outstanding developments the company (jointly owned by Standard Oil Company of California and Barber Oil Company) has made:

MINING—Pioneered and perfected the world's first hydraulic jet stoping method in a vertical vein.

Is the first company in the world to pump, on a commercial scale, all its ore to the surface through a water filled column.

Transports by water all broken ore to the pump shaft in a ditch.

Operates the world's first mine to produce more than 500 tons of ore per day from a vein without using a single stick of powder.

mile pipe line between the mine and refinery. with a 38 percent density is pumped through The 350 gallons of slurry per minute moves at tance ore pipe line in world.

Refining: A combination of delayed coking and thermal cracking yields 250 tons of high purity metallurgical coke and 1,300 barrels of high octane gasoline from 630 tons of ore daily. Feed heating furnaces, coking drums, and decoking towers are shown.

Method Stopes Gilsonite For Gasoline

And will be the first company in the world to continuously stope vein ore over a 10-mile strike length.

PIPE LINING—Designed and built the world's first long distance crude ore pipe line.

Is the first to successfully operate this high pressure pipe line to transport solid materials.

REFINING—Built and operates the first privately financed plant in the United States to produce conventional petroleum products from a raw material other than crude oil.

What Is Gilsonite?

Gilsonite is not new; in fact, it has been mined since 1885 for a variety of special applications, including ink, phonograph records, paints, battery cases, etc.

Gilsonite occurs in very straight vertical veins cutting the upper Green River shales, and lower and middle Uintah sandstones and shales of Tertiary age. Ore shoots are found only in the Uintah formation as veins split and finger out in the underlying shales. These formations dip 2 to 3° northwest and this dip is important in mining as described below.

At normal temperatures Gilsonite is a solid hydrocarbon related to Wurtzilite, Grahamite, etc. It is soluble in hot oil; it will not burn. However, Gilsonite dust is extremely explosive and a number of serious mine explosions over the years created mining problems which had to be overcome if large-scale mining operations could be carried out to supply adequate tonnage to a gasoline refinery. Remember that Gilsonite ore occupies 30.9 cubic feet in the vein and mining the projected 900 tons of ore per day (five day week) for the continuously operating refinery requires large-scale mining. Remember also that the stoped volume would be equivalent to mining about 2,500 tons of sulphide vein ore per day.

Surface vs. Deep Mining

Open trenching is used to mine the upper 40 feet of the vein where ease of ventilation precludes explosive hazards. Stopes are stulled and the mined out outcrop lagged solidly and then covered with dirt.

Deep underground mining presented a problem. Fortunately vein walls are remarkably stable so that open stoping was practical with roof bolting and stulling of slabs necessary in only scattered spots.

Shrinkage stoping, used at one of earlier mines, was ruled out because of the hazard of large volumes of broken ore and the trouble drilling overhand holes. Underhand stoping was selected and a new method of breaking ore in a dust-free atmosphere to prevent explosion was developed. Dust-free logically meant a very moist atmosphere with introduced water. Soon high pressure (2,000 pounds per square inch) water jets were being tried to blast the ore free from the vein. This method worked in the wide Cowboy vein where ore has a prefractured nature and is the source of ore for gasoline refinery. In the harder and narrower Bonanza vein water sprayed mechanical cutters are used.

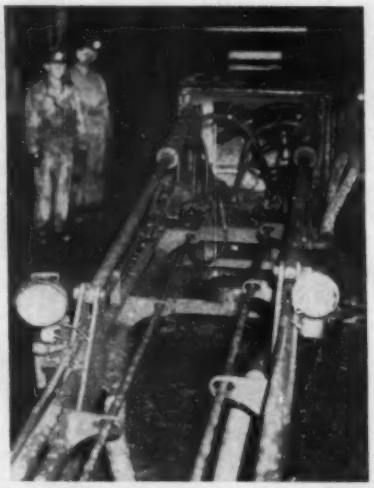
The Hydraulic Cutter Car

To hold and control the water jets, a special air driven crawler type cutter car was built with two hydraulically controlled booms. High pressure water is piped to the car and through the booms to ¼-inch nozzles which direct jets directly into the ore. The car is advanced by air motors and a second air motor operates a hydraulic pump for boom controls. The twin booms are positioned individually against the face. Movement

of the car and the booms is controlled from within the car. An auxiliary stream of low pressure water (60 pounds per square inch) is used to flume the cut ore away from the face. Cutting advances updip from the shaft at about 3° so that broken ore will flow to a shaft through a trench jetted in center of the vein. Cuts are advanced 12 feet high and in good stoping ore an 80 foot advance will be made per shift in the 16-foot-wide vein. Despite the large volume, this is only 400 tons of ore. But, that is high production for only two men. However, it takes a crew of 15 men—timber men, pipe men, hoist man, bosses, etc.—to keep one car jetting.

As the car advances the timber crew cuts hitches and bolts bad slabs behind it. Head boards and chain link fencing are used as wall support and anchored in place by bolts. Mining cuts normally are 500 feet long, midway between shafts, or can be the full 1,000 feet. When one cut is finished the cutter is lowered for the next cut.

Normally rows of stulls are carried at 50-foot vertical intervals and two-inch link mesh, No. 9 gauge, galvanized fencing is stretched tight over top and stapled to the stulls. This fencing has proved very effective in catching and holding any loose rock or falling slabs. In several instances a stull has been knocked loose but the elasticity of the fencing prevented any rock falling into stope below. If lagging had been used the rock would have broken it and dropped through into stope. Both high and low pressure water lines and the air line are carried on these stulls. Service pipe lines are dropped into stopes from



TWIN BOOMED jet cutter is used to mine ore from Cowboy vein. Water at 2,000 pounds pressure blasts ore from face.

which high pressure hoses connect with the cutting cars. Special high pressure Victaulic couplings were developed for water lines.

Gilsonite pillars, thicker than the vein width, are left at 200- to 300-foot vertical intervals. They will be recovered later.

Mine Updip-Timber Off Shafts

The mining plan calls for initial mining to the southeast. This is important as the bottom of the mineable ore dips northwest so all broken ore will flow down dip to the E3 production shaft. This shaft was sunk in the vein using air hammers to break ore. As mining extends from this shaft, service shafts will be placed at 1,000-foot intervals along the strike. Already the E1 and E2 shafts are in use for lowering men, timber, supplies, and for high pressure water lines. It is important to remember that these shafts were timbered off—not sunk—in the stoped out vein. This is the way all shafts will be "sunk" in the future.

Ore Pumped To Surface

The E3 production shaft is 940 feet deep. The sump extends 140 feet below the mineable ore. All broken ore flows down other shafts to bottom level and is flumed to this shaft. Slurry, water and ore flowing at an average rate of 700 gallons per minute, is screened with the minus-¾-inch portion dropping into the sump and the oversize being crushed in a jaw crusher. Two deep well pumps with 100-foot-long columns are placed at top of sump. These pumps discharge directly into the first of five Barrett Haentjens centrifugal station pumps connected in series. A sixth pump is not necessary now for tonnage presently mined. The fifth station pump discharges slurry into 6-inch pipe column at 350 pounds pressure leading to the surface preparation plant.

Two propeller type agitators keep the slurry in suspension in the sump below the deep well pump intakes. To insure additional agitation, compressed air is bled from a small line below intakes. All pump glands have fresh water seals.

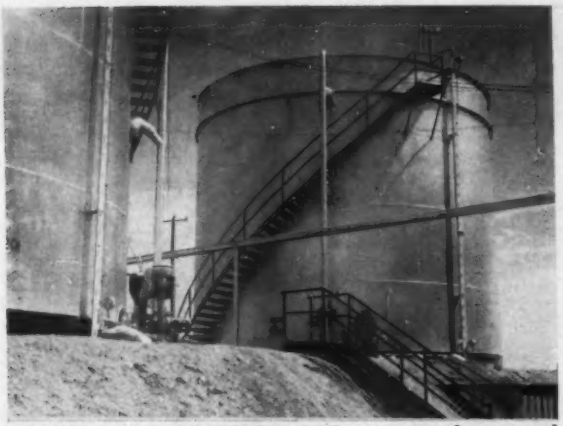
Preparation Plant

Gilsonite ore must be carefully sized before it can be pumped to the refinery so a new plant has been built

TOP 50 FEET of vein is mined as open cut then timbered. Picture taken on Cowboy outcrop with ore in foreground.

SOLID FACE of Gilsonite. See how water jets have cut channels which show as dark marks at upper and lower left.

VARIABLE SPEED centrifugal pump used to elevate ore and water 800 feet to surface. Five pumps are used in series.



CRUSHED AND SCREENED ORE, minus-¾-inch, is stored in these two 5,000-barrel tanks at a density of 38 percent as pipe line feed. Bottom agitation keeps ore in suspension.

STRAIGHT AS AN ARROW the Cowboy vein crops out under three headframes made of converted oil well derricks. Miners in foreground place stulls across open stopes mined from surface.

to: (1) size ore; (2) provide ore storage for seven days of pumping to refinery with five days mining; and (3) maintain pipe line feed at proper viscosity.

In the plant ore is screened, oversize crushed in slow speed roll crusher, rescreened, dewatered by cyclones, recrushed, dewatered, thickened, and pumped to one of two 5,000 barrel storage tanks. About 600 gallons of water per minute are reclaimed and pumped to the E1 shaft for trench water. Pipe line feed is minus-¾-inch. Slow speed crushers are used to minimize production of fines which complicate refinery filtering. Ore is mined faster than pipe lined so storage is built up inside large building. Ore is reclaimed by hydraulicking. Final storage tanks are continuously agitated by impellers in tank bottoms. Feed to pipe has a density of 38 percent. Initially it was 35 but is being increased gradually with no pipe line troubles.

Pipe Line Pumps

Prepared slurry from storage tanks is drawn off at 350 gallons per minute as feed to two Wellman Snyder horizontal pumps in series. These pumps are driven by 300-horsepower electric motors and operate at 2,000 pounds per square inch pressure. Discharge from second pump is directly into pipe line. The slurry flows through the 6-inch line at three miles per hour. From the mine the line, buried below frost line to prevent freezing, rises 3,400 feet to the top of Baxter Pass. From the pass the line is downhill to refinery. This is the world's first long ore pipe line and has operated perfectly from the start. There has been some particle degradation in line so far. Capacity can be increased with ease by adding extra pumps to increase flow velocity. Pipe line cost was about $2,000,000 and it will pay for itself in the first year of operating in savings in transportation costs over trucking. Piping cost per ton of ore is about $1.00.

An 800-horsepower Enterprise Diesel engine drives an eight-stage Bingham centrifugal pump in the preparation plant. This unit regularly supplies 2,000-pound water for jet mining but is automatically cut into pipe line feed in the event of an electrical failure. A water tank at the top of Baxter Pass is full at all times to gravity flush line in either or both directions in event of total breakdown in pumping equipment.

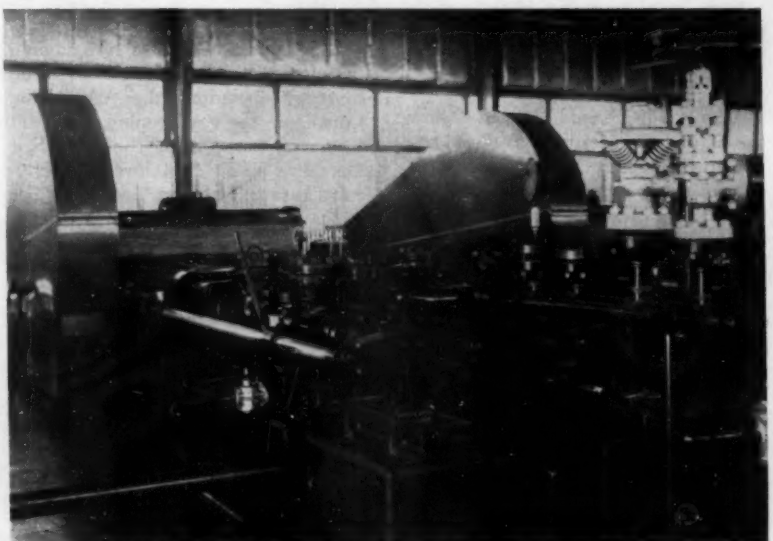
Gilsonite Refinery

At the refinery the pipe slurry is depressed and Gilsonite separated from water with an Eimco disc filter using Nylon cloth. As the ore is completely insoluble in water, filtering is not difficult and filtrate is clear. However, fineness of ore has a direct bearing on filtering rate.

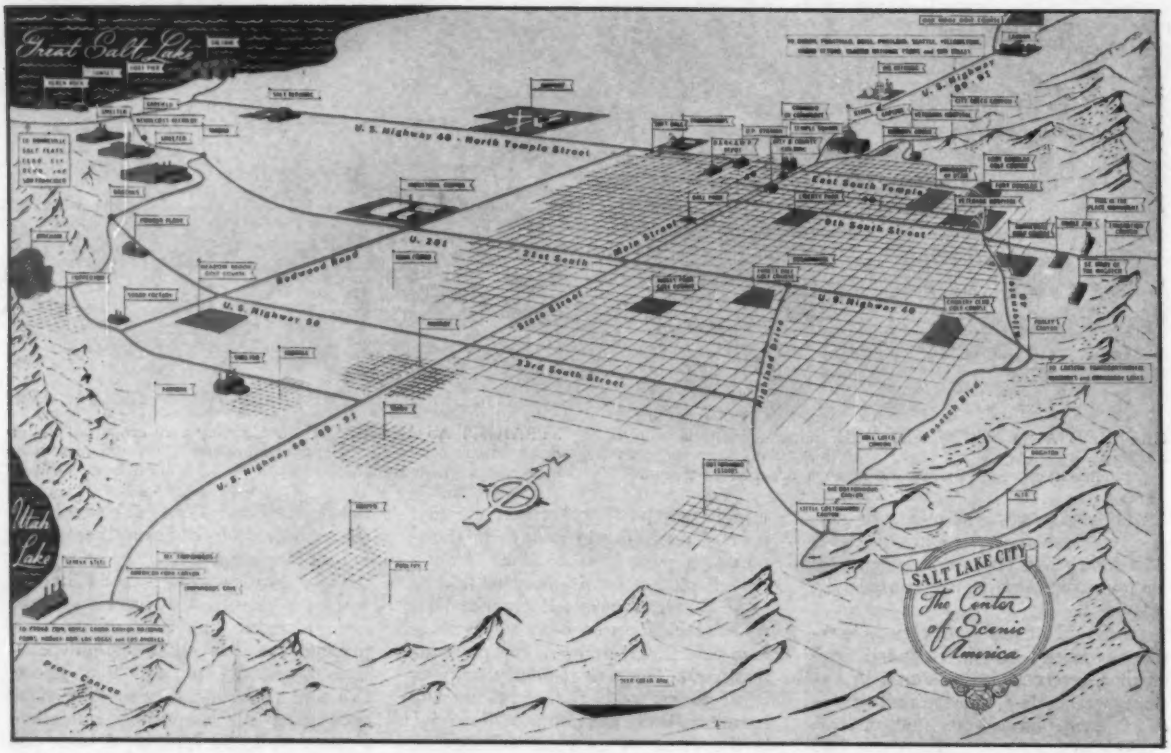
Cake (ore) which is solid hydrocarbon is dissolved in hot recycle oil and charged to refinery passing through the delayed coker and catalytic reformer. From 630 tons of ore 275 tons of high purity metallurgical coke used for aluminum reduction electrodes, 1,300 barrels of high octane gasoline, and enough plant fuel-gas for normal operation are recovered daily.

E. F. Goodner, American Gilsonite president, gives credit to his staff for the entire project and commended them on not being afraid to try something new. Results prove that the staff tried many things and fortunately found some that worked to make the entire project a success.

THE END



TWO WILSON SNYDER HORIZONTAL pumps, in series, are used to force Gilsonite-water slurry through the pipe line at a pressure of 2,000 pounds per square inch. Pumps require 570 horsepower.



"This Is the Place"
Salt Lake City Welcomes the AMC

By J. M. TAYLOR
News Editor

Many AMC members will follow the path of the Mormons as they journey to Salt Lake City for this year's annual convention. The historic city founded by Brigham Young is host to the 1957 American Mining Congress.

AMC meetings are noted for their basic, practical approach to the industry's problems—economic, legislative, and operating—and this year will be no exception. Top management of the leading U.S. mining companies will serve on the panels discussing such topics as "State of the Mining Industries," "What Are Our National Policies?," "What's Ahead for Taft-Hartley," "Relative Economy of Six, Eight, and Ten-Yard Shovels," "Future of Nuclear Reactor Power," and "Bacterial Leaching of Manganese Ores."

The ladies, of course, are invited to attend the regular Convention functions—including the Welcoming Luncheon; the gay evening parties at Saltair on the shore of the Great Salt Lake, and on the 6190 level of Kennecott's famous Bingham Canyon copper mine; and the "Speechless Banquet."

In addition, special daytime events have been arranged: a luncheon and fashion show on the campus of the University of Utah; a branch at the Fort Douglas Gold Club or Salt Lake County Club, and a special organ recital at the Tabernacle.

Two field trips have been arranged. One is a visit to the Geneva Steel Plant, and enroute the party will pass the Midvale smelter. The second is a circle tour of a number of mining and metallurgical plants, including the U.S. Smelting plant for the Lark and U.S. mines; Kennecott's Magna mill; and Utah Power and Light's Gadsby steam electric station. Enroute, visitors will see the Salt Lake Tungsten refinery, Vitro Uranium's mill, the Hercules Powder plant, Kennecott's electrolytic copper refinery, the Garfield copper smelter of ASARCO, Calera Mining's cobalt refinery, the Western Phosphate plant, and the Saltair plant of Morton Salt Company.

Between technical sessions and social events, the city itself offers much to keep the visitor occupied. Salt Lake City is rich in history—particularly that of the Mormons for it is the world headquarters of the Church of Jesus Christ of Latter-day Saints. It was a part of isolated Mexican territory when the Donner party passed through in 1846. A year later the first group of 148 Mormon Pioneers arrived in the Salt Lake Valley. Seeking refuge from religious persecution, they

Bingham Canyon Copper Mine

The world famous open pit of Utah Copper Division of Kennecott Copper Corporation is 28 miles southwest of the city.

Temple Square

On a 10-acre plot within the heart of the city are the spired Temple, oval roofed Tabernacle, Assembly Hall, and museum of the Latter-day Saints.

Big Cottonwood Canyon

One of six canyons reached within minutes of the city. Numerous campgrounds and picnic areas have been developed here by the Wasatch National Forest.

Capitol Building

Constructed of Utah granite with a dome of Utah copper, the state capitol houses many pioneer relics and mineral exhibits.

Great Salt Lake

The saltiest body of water, except for the Dead Sea, Great Salt Lake contains about 27 percent salt. You float like a cork because of the water's buoyancy.

"This Is The Place" Monument

Pioneers of 1847 entered Salt Lake Valley through Emigration Canyon. Monument marks the spot where Brigham Young made his famous decision to stay.

Convention Calendar

MONDAY, SEPTEMBER 9

9:45 A.M. What Are Our National Mineral Policies?—Newhouse Hotel
12:15 P.M. Welcoming Luncheon—Rainbow Randevu
2:00 P.M. Labor Relations—Newhouse Hotel
2:00 P.M. Exploration and Geology—Newhouse Hotel
2:00 P.M. Milling and Metallurgy—Newhouse Hotel
6:00 P.M. Miners Jamboree—Saltair

TUESDAY, SEPTEMBER 10

9:30 A.M. State of the Mining Industries—Newhouse Hotel
9:30 A.M. Underground Mining—Newhouse Hotel
9:30 A.M. Open Pit Mining—Newhouse Hotel
12:15 P.M. Strategic Minerals Lunch—Hotel Utah
2:00 P.M. Public Lands—Newhouse Hotel
2:00 P.M. Safety and Health—Newhouse Hotel
2:00 P.M. Milling and Metallurgy—Newhouse Hotel
6:00 P.M. Kennecott Party at Bingham Canyon

WEDNESDAY, SEPTEMBER 11

9:30 A.M. Tax Panel—Newhouse Hotel
10:45 A.M. Gold, Silver, and Monetary Policies—Newhouse Hotel
9:30 A.M. Open Pit Mining—Newhouse Hotel
9:30 A.M. Underground Mining—Newhouse Hotel
12:00 Noon AMC Board of Governors Lunch—Hotel Utah
2:00 P.M. Uran um—Newhouse Hotel
2:00 P.M. Industrial Engineering, Management Problems—Newhouse Hotel
2:00 P.M. Underground Drilling Symposium—Newhouse Hotel
2:00 P.M. Industrial Minerals—Newhouse Hotel
7:15 P.M. Annual Banquet—Rainbow Randevu

THURSDAY, SEPTEMBER 12

9:30 A.M. Tax Forum—Hotel Utah
8:15 A.M. Field Trip—Geneva Steel Plant
8:15 A.M. Circle Tour of Mining and Metallurgical Plants

had traveled a thousand miles from the frontier settlements of Missouri. Four days after their arrival (July 24, 1847), Brigham Young walked to a spot of ground between two forks of a small mountain stream and declared "Here we will build a temple to our God." A stake was driven on the site and the 10 acres now comprising Temple Square became the center of the city.

Construction of the Temple was started in 1853, and completed in 1893. It is reserved for sacred ceremonies and is not open to the public. The 12½-foot statue atop the spired building is made of copper covered with gold leaf.

The Tabernacle was started in 1863 and completed sufficiently to hold a general church conference in October 1867. Today its seating capacity is 8,000, although as many as 11,500 people have gathered under its roof at one time. The world famous organ in the Tabernacle was first used in 1867. It now has nearly 11,000 pipes ranging from ¾ of an inch to 32 feet in length.

The Assembly Hall, constructed between 1877 and 1882, is the place of public worship and serves as a social center as well. All services are open to visitors.

Temple Square also contains many interesting monuments, perhaps the most unusual of which is the Sea Gull monument. Erected in 1913 it commemorates the "mercy of God to the Mormon Pioneers in the summer of 1848." The group had planted 5,000 acres of grain shortly after their arrival in the valley to insure food for themselves and the many colonists who were expected to join them that summer. Then suddenly in the spring of 1848, great hordes of crickets descended upon the fields and began to devour the grain. The people did all they could to destroy the insects and to save the crop but to no avail. When all hope seemed gone, they lifted their voices in prayer. The sudden arrival of sea gulls from the west turned the tide. The gulls devoured the crickets, and saved a substantial part of the crop so that the pioneers were able to survive the following rigorous winter. Since that time, both sentiment and law have protected the gulls within the state of Utah.

In the southeast corner of the Square is the oldest house now standing in the city. This was built in the fall of 1847, and once served as an office for Captain Howard Stansbury of the Army Topographical Engineers who surveyed the Great Salt Lake during 1849-50. The museum on the Square houses many interesting relics of the early west.

United States

Personalities in the News——

EARL L. BILHEIMER will assume duties as resident manager of the Meramec Mining Company, recently organized under joint ownership of St. Joseph Lead Company and Bethlehem Steel Company to develop and mine deposits of magnetite and hematite near Sullivan, Missouri. Mr. Bilheimer has been associated with St. Joseph Lead Company since 1922, serving mostly in operating supervisory capacities but more recently as manager of the Employee's Relations Department.

Douglas Brockie, senior geologist with the Eagle-Picher Company's Tri-State district in Oklahoma, has been promoted to chief geologist. Mr. Brockie succeeds **Joseph P. Leyden**, who will retire in September. Succeeding Mr. Brockie as senior geologist is **Richard C. Lundin**, who has been working with him in the Tri State field. **William E. Arnt** was recently promoted to senior geologist in Illinois-Wisconsin area operations.

Montis R. Klepper, associated with the United States Geological Survey in Spokane, Washington for the past 10 years, will transfer to Washington, D. C. operations as assistant chief geologist. Mr. Klepper has been associated with the U. S. Geological Survey since 1943.

Billy B. Smith is now acting maintenance superintendent of Kennecott Copper Company's Nevada mines division at McGill. Mr. Smith has been employed by Kennecott since 1954 and has served as industrial engineer at the mine, concentrator, and smelter. He succeeds **Rush Muse** who was transferred to the New York office.

Dr. Rene Engel recently moved his petrographic and geochemical laboratory from South Pasadena, California to Wofford Heights, California where he is now available as consulting geologist.

Conrad B. Fredricks has been promoted to assistant to the superintendent of the general laboratory and sampling department of the Anaconda Aluminum Company at Columbia Falls, Montana. Mr. Fredricks has been with the laboratory staff since 1955.

Eugene C. Anderson, mining engineer, recently retired from the New Mexico Bureau of Mines and Mineral Resources and has opened a consulting office in Socorro, New Mexico.

Dr. Alex Stewart has been named president and general manager of the newly formed R-N Corporation, equally owned by National Lead Company and Republic Steel Corporation, with offices in New York City. Mr. Stewart was formerly director of research for National Lead Company and supervisor of the company's atomic energy activities. C. M. White, Republic's chairman, is also chairman of the board of the new corporation. Vice presidents are **Alfred H. Drewes**, vice president and director of National Lead, and **Peter Robertson**, vice president in charge of research and planning for Republic.

Fred H. Crosby, superintendent of the United States Smelting, Refining and Mining Company's Continental mine near Silver City, New Mexico, has been transferred to the Bessemer iron mine in Lucerne Valley, California. The Bessemer mine is a Kaiser Steel Corporation property under contract to C. M. & H. Mining Company.

C. W. Aronson has been appointed vice president of Meridan Iron Company of Minneapolis, Minnesota. Succeeding him as general manager is **James R. Stewart**, former chief engineer. **Peter F. Torreano**, former assistant superintendent of the Peterson mine of Pickands Mather & Co., will replace Mr. Stewart as chief engineer of Meridan Iron Company.

John Boley has transferred from Pickands Mather & Co.'s Mahnomen mine on the Cuyuna range to the West Hill mine, of Western Mining Company, a Pickands Mather subsidiary, as master mechanic.

Charles Will Wright recently completed 12 reports on "What the American Mine Investor Wants To Know About The Latin American Republics" for the U. S. Bureau of Mines. These reports will be published in the form of an Information Circular by the Bureau of Mines.

W. W. Little, former mine superintendent of the Copper Queen Branch of Phelps Dodge Corporation at Bisbee, Arizona, has been promoted to general superintendent. **H. D. Clark**, assistant mine superintendent of the Copper Queen Branch, will succeed Mr. Little as mine superintendent.

Lowell B. Moon is the new development manager of Kennecott Copper Corporation, New York City offices. Mr. Moon was previously mining geologist in charge of Kennecott's subsidiary, Bear Creek Mining Company's Spokane district office. He will be replaced there by **Glenn C. Reed**, assistant district geologist in Spokane.

Horace Y. Bassett, executive vice president of Calumet & Hecla, Inc., Chicago, Illinois, has been elected president and chief executive officer. He will succeed **Endicott R. Lovell** who is retiring.

H. H. GILL, (right) foreman of the mine blacksmith shop, Kennecott Copper Corporation's Chino Mines Division in Hurley, New Mexico, received the Joseph A. Holmes Certificate of Honor from E. A. MORGAN, representing the United States Bureau of Mines. The award was made in recognition of the department's record of seven years operation without a lost time accident. A similar award was received by the mill electrical department.

STANLEY D. MICHAELSON is the 1958 nominee for president of the Society of Mining Engineers of the American Institute of Mining, Metallurgical, and Petroleum Engineers. He will also serve as director of AIME. Mr. Michaelson is the chief engineer of Kennecott Copper Corporation's Western Mining Division in Salt Lake City, Utah. ELMER A. JONES, manager of Southeast Missouri Division of the St. Joseph Lead Company, is the current Society president. Mr. Jones has been nominated to be an AIME director.

Ernest L. Ohle has been appointed chief geologist in charge of the geology departments of both Copper Range Company and White Pine Copper Company. Mr. Ohle has served with American Zinc, Lead and Smelting Company, St. Joseph Lead Company, and taught courses about mineral deposits at Washington University.

John B. Adamec has joined the staff of International Nickel Company's research laboratory at Bayonne, New Jersey, as a research metallurgist. Mr. Adamec was previously employed as research metallurgist and chief metallurgical engineer with Sintercast Corporation of America.

Percy Gordon Beckett, consultant and member of the board of directors of Phelps Dodge Corporation, received the honorary degree of Doctor of Science at University of Arizona commencement ceremonies recently.

Bruce Karinen was recently employed as geologic trainee at Anaconda Company's mill in Bluewater, New Mexico. Anaconda employee **Alton Head** will resign soon to develop property of his own in the Ambrosia Lake area. **Sydney Gottlieb** has returned to Anaconda Company's metallurgical testing section at Anaconda, Montana.

L. G. Woodworth, of the Mauthe Mining Company, has been transferred to the Peterson mine, Michigan, as assistant superintendent. **Albino J. Cigallio**, former assistant superintendent at the Anvil-Palms mine, has been promoted to assistant superintendent of the Mauthe Mining Company.

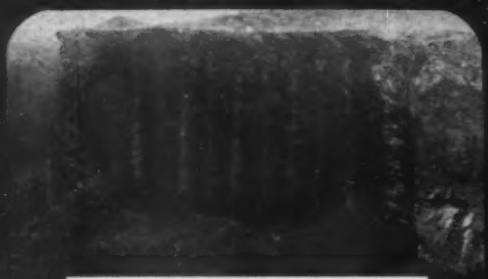
Dr. Milton LeBaron was recently elected vice president in charge of research for International Mineral and Chemical Corporation, Chicago. **William Bellano** was elected vice president in charge of engineering and **Anthony E. Cascino** will serve as vice president in charge of marketing.

Blair Burwell and Dennis W. Viles were re-appointed to new six-year terms on the State Metal Mining Fund, Denver, Colorado. **Robert Wil-**

Continued on page 127

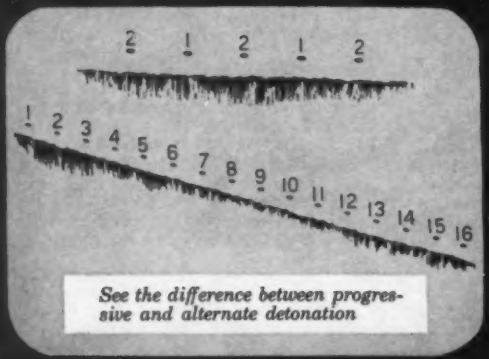
TO HELP YOU BLAST WITH GREATER ECONOMY

The INSIDE STORY



See how modern blasting methods improve breakage

See how the point of initiation affects rock movements...controls throw



See the difference between progressive and alternate detonation

Don't miss this movie for men who use explosives in Quarries, Strippings and Construction!

Here is a motion picture that gives the facts on modern blasting techniques. It shows how you can save money through better, more complete fragmentation . . . how you can increase safety by eliminating the need for secondary blasting . . . and how your public relations can be improved by holding noise and vibration to a minimum.

"*The Inside Story*" is prepared by Atlas Powder Company as a technical service. Show it to your organization for a better understanding of scientific blasting. It explains in detail how the point of initiation affects blasting results . . . how millisecond delay techniques and alternate velocity loading are used to gain maximum efficiency.

This information also makes "*The Inside Story*" well suited for showing at institute meetings and to other engineering groups.

How to get the film. Simply write us on your letterhead, telling us at what type of meeting you'd like to show "*The Inside Story*," and approximately when you'll need it. We'll try to ship a print to you well in advance of the date you select.

Ask also about other Atlas educational material such as the films, "*How to Handle Women and Explosives*" (for your safety meetings), and "*We're Blasting Near You*" (to show to your neighbors). And write for "*Better Blasting*," the informative Atlas newsletter on latest blasting materials and methods.

EXPLOSIVES DIVISION

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Newsmakers in International Mining

NOEL M. KENNY is the new general manager of Roan Antelope Copper Mines, Ltd. in Luanshya, Northern Rhodesia. Mr. Kenny, a native of Southern Rhodesia began his mining career there in 1928. Two years later he joined the New State Areas Gold Mining Company, Ltd., in South Africa and in 1940 was appointed section manager of Randfontein Estates Gold Mining Company in the same year and retained that position until 1947. In 1948 Mr. Kenny joined the Roan Staff as assistant mine superintendent and in 1950 was appointed assistant manager. Since October 1951, he has been manager of the company.

Blair Burwell, president of Minerals Engineering Company, Grand Junction, Colorado recently visited the new vanadium plant being constructed in Transvaal, Union of South Africa by the Minerals Engineering Company South America, (Pty.) Ltd.

U Kyaw Hla, employed by the Mineral Resources Development Corporation of Burma, recently arrived at the Steep Rock Iron Mines, Ltd., Ontario, Canada to spend two months there studying heavy mining machinery and Diesel equipment. Mr. Hla will spend three years in Canada as part of the Colombo plan set up by the Burmese government to gain knowledge of Diesel operations, and mechanical equipment.

T. R. Ragland, technical vice president of the Union Carbide International Company, spent several days in Sydney, Australia conferring with executives of Timbrol Ltd. on the proposed merger between that company and Union Carbide and Carbon Corporation. Union Carbide International is a subsidiary of Union Carbide and Carbon Corporation.

Mrs. Mary A. Marsman was re-elected president of Palawan Consolidated Mining Company at a recent stockholders meeting in Manila, Philippine Islands. Other officers who retained their positions are **George H. Newman**, vice president, and **Zoilo C. Alberto, F. H. Burgess, F. Ortigas, Jr.**, and **A. L. Velilla**, directors.

Dr. G. H. Charlewood has been appointed vice president of Heath & Sherwood Drilling, Ltd., Kirkland Lake, Ontario. Dr. Charlewood has been serving as chief geologist of the Manitoba Department of Mines and Technical Resources.

Miguel A. Carrizales, Enrique Mata, and **Alfonso Zuzunaga** received one-year postgraduate scholarships in the United States from the Cerro de Pasco Corporation. All three men have been employed as company foremen for Cerro de Pasco Corporation in Casapalca, Cerro de Pasco, and La Oroya, Peru. The three students are now enrolled at the Colorado School of Mines, Golden, Colorado.

H. F. Nelms has been named managing director of Algom Uranium Mines, Ltd., a subsidiary of Rio Tinto Mining Company of Canada, Ltd. He will replace **R. C. Hart** who has been appointed district manager for Rio Tinto Management Services at Elliott Lake, Ontario, Canada. Other advancements in the Rio Tinto company are as follows: **G. L. Hatherly** will assume responsibilities as mine manager at the Algom Quirke mine. Former mine superintendent of the Algom Nordic mine, **M. A. Airth**, was advanced to mine manager. **A. M. Glendenning** will take over as manager of Northspan Uranium Mines, Ltd. He succeeds **D. G. Rowe** who has been named manager of Northspan's Lake Nordic mine. **R. D. Lord**, present mine manager of Preston East Dome Mines, Ltd., has been named managing director of both Pronto Uranium Mines, Ltd. and Rix-Athabasca Uranium Mines, Ltd.

F. B. Michell, mining and mineral dressing engineer, is now employed on a project of alterations to the concentrating plant at South Crofty, Ltd., Redruth, Cornwall, England.

C. Jay Parkinson has been elected to the board of directors of The Anaconda Company and three subsidiaries: Andes Copper Mining Company, Chile Exploration Company, and Chile Copper Company. Mr. Parkinson was recently named general counsel for Anaconda and is also a vice president and director of the Anaconda Aluminum Company.

Mateo Dolleton, Jr. has been transferred to the staff of the mine department of Atlas Consolidated Mining & Development Corporation, Toledo, The Philippines. He was formerly in the exploration department.

George Shoechle of the United States Geological Survey has been visiting geological missions in Latin America operated under auspices of the International Cooperation Administration.

Adolf Esch has joined the staff of Gewerkschaft Mannesmann at Gutenbergstrasse, German Federal Republic. He will be managing director of several of the company's small iron mines.

Three French mining men recently visited Africa on a tour of mining operations there. Included in their tour were the cobalt and copper developments in Northern Rhodesia. The visitors are (from left to right) PAUL RAFINTO, metallurgist; M. REY, professor at the Paris School of Mines and PIERRE WALINE, mining engineer. All three men are from Paris, France.

RAYMOND BROOKS, president and general manager of New Discovery Mining Corporation, is carrying out active prospecting on behalf of American Smelting & Refining Company at Kasonso Mine in the Mumbwa district of Northern Rhodesia. Mr. Brooks was formerly manager of exploration for Rhodesian Congo Border Concession during the 1920's, which was largely responsible for the discovery of the Mufulira copper ore body.

N.A.B. Hill is the new general manager for Indian Copper Corporation, Ltd., District Singhbhum (Bihar) India, replacing **E. R. Dempster.**

Mazlum Öget has accepted the position as assistant general manager for Kömür Isletmeleri A.S., Ankara, Turkey.

Howard F. Bartlett has left Salt Lake City, Utah to join the staff of Marcona Mining Company in Lima, Peru.

Dr. Y. William Isachsen, U. S. Atomic Energy Commission geologist from Grand Junction, Colorado, will act as technical advisor to the Turkish government in setting up a uranium exploration program for that country.

J. A. Becking has been appointed consulting engineer for the General Mining and Finance Corporation group, in the Transvaal, replacing **M. C. G. Mever**, retired. **J. A. Nixon** is new assistant consulting engineer; **F. R. Nott** succeeds Mr. Nixon as manager of the Buffelsfontein mine; and **A. R. Cator** fills Mr. Nott's former position as manager of the Ellaton mine.

R. Ellerton Binns of London, chairman of the board for Mountain Copper Company, Ltd., visited San Francisco Chemical Company's phosphate operations in Idaho, Utah, and Wyoming recently. Mountain Copper is the parent company of San Francisco Chemical.

R. M. McNutt of Canada was in Johannesburg, Union of South Africa recently demonstrating a new type of vibrating spiral concentrator.

Charles V. Harris, mining and metallurgical engineer, is currently supervising the building of a standard gauge railroad and a mine expansion program for the Cuba government in the Nicaro area, and also supervising the design and construction of a $1,000,000 process pilot plant at Nicaro. He recently completed the job of industrial engineer, directing the work of prime and sub-contractors at the $40,000,000 expansion project of the United States government-owned nickel plant at Nicaro. He will soon take over duties as assistant resident engineer for General Services Administration in Nicaro, and assistant administrator of Cuban Nickel Company.

AT WHITE PINE COPPER MINE

USS "T-1" Steel consistently

*Feeder chute liners last 2 to 3 times longer

Hard and flinty copper ore plays hob with ordinary materials. That's why virtually all the feeder and transfer chutes in White Pine's crushing plant are now lined with USS "T-1" Steel. Quenched and tempered to 321 minimum Brinnell, USS "T-1" Steel liners, ⅜" thick, have proved far longer-lasting than materials formerly used—give from 2 to 3 times longer service. These "T-1" Steel liners are easy to fabricate, are readily flame-cut to size—a great advantage over cast, anti-abrasive materials.

Also available from United States Steel—our well-known USS High Strength Steels, for many years standards for mining and ore handling equipment.

USS

outperforms other materials

Provides very high resistance to impact abrasion plus superior strength and toughness that keeps equipment in service far longer than before*

WHITE PINE COPPER'S experience with USS "T-1" Steel is typical of the improvements in service that this remarkable steel makes possible.

Wherever they have used it to replace former construction, equipment life has been materially increased. Repair and maintenance costs have been cut. Down time has been reduced. All this means important savings in time and money—savings that are far greater than the difference in initial steel cost.

USS "T-1" Steel is unique. There's never been another commercial alloy plate steel just like it. None better able to stand up to the brutal abuse inflicted on mining equipment . . . and as readily handled in fabrication . . . *and* so economical on the basis of performance.

*Loader plates last 8 to 12 months longer

At White Pine Copper, USS "T-1" Steel, supplied to 321 minimum Brinnell, is used in the bottom and side plates of the conveyor of this loading machine. Also, in the plates on its underside along which the returning conveyor chain slides. Prime requirements here are toughness and high resistance to impact abrasion. Every one of these underground loaders has been overhauled since the mine was opened and, in every case, USS "T-1" Steel has been used to increase durability. The result—8 to 12 months more service life.

Here's why USS "T-1" Steel can help you improve your equipment

When you want strength far beyond the ordinary, you can get it with USS "T-1" Steel—for, with a minimum yield strength of 90,000 psi and a minimum tensile strength of 105,000 psi, USS "T-1" Steel is nearly three times as strong as structural carbon steel. This is far higher yield strength than has ever before been available in weldable plate steel. What's more, its strength is not lowered by welding or gas cutting.

For equipment subject to impact abrasion, USS "T-1" Steel can be obtained quenched and tempered to a minimum hardness of 321 Brinell. Even this very hard grade can be welded and flame-cut *right in the field* without preheating. That means you don't have to shut down costly, big-capacity equipment for the many hours generally required for shop repairs.

If your equipment must withstand severe impact abuse, USS "T-1" Steel insures against damage in winter weather. Whether furnished to 321 minimum Brinell or to 90,000 psi minimum yield strength, it has exceptional toughness and resistance to brittle failure, even at temperatures far below zero.

Our new catalog—USS "T-1"—is complete with technical information and offers many practical suggestions for its use that can save *you* money. For your free copy, write to United States Steel Corporation, Room 5639, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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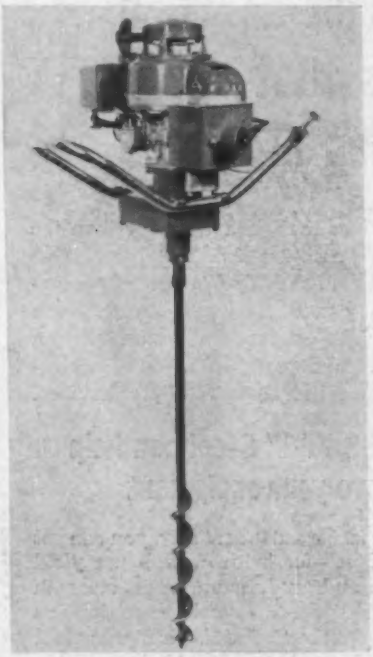
UNITED STATES STEEL

PRODUCTION EQUIPMENT PREVIEW

PEP is just what new equipment, increased mechanization, and new methods can give to your mine, mill or smelter. This PEP section is MINING WORLD's way of making available to you some of the finest current information on mechanization.

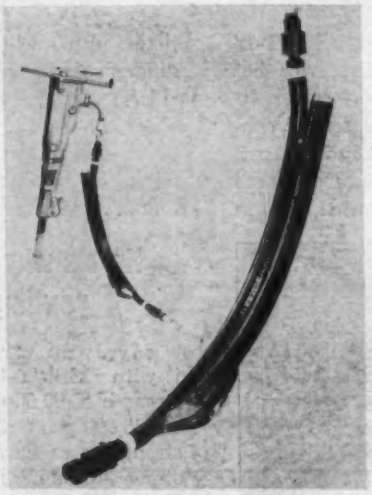


General Power Drill is Lightweight and Powerful

Here is a new auger and drill, gasoline powered, light in weight, and designed for one man operation. Weighing only 28 pounds, the drill is powered by a 2½ hp, two cycle engine, with rewind starter driving the bit through a 17⅞ to 1 gear reduction. Bit speed is 200 rpm. For additional information circle No. 57.

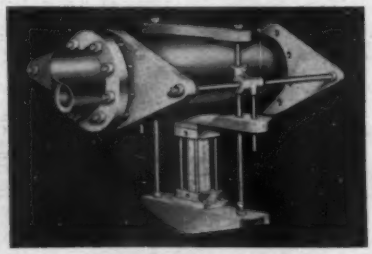
Subsurface Exploration Without Drilling

A new instrument for shallow subsurface exploration without drilling has been announced by Geophysical Specialties Company. The Model MD-1 Refraction Seismograph is used for determining depth to bedrock, the presence or absence of bedrock or solid material at any depth up to 50 feet, and identification of subsurface materials without drilling. Features include miniature size, direct reading, and simple easily-taught operation. Using complete transistorization, the weight of the entire equipment exclusive of sledgehammer source is only 16 pounds. Circle No. 59 for additional information.



New Lightweight Oiler Made From Neoprene

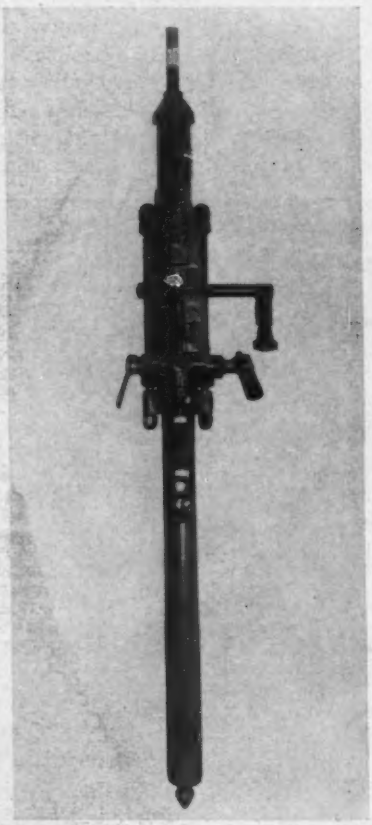
This flexible neoprene oiler for pneumatic machines, holds an eight hour supply of oil. An automatic venturi valve controls lubricant flow, and a positive shut-off valve automatically stops flow when air stops. All working parts are accessible for easy maintenance. Circle No. 58 for additional information.



New Model Pinch Valve For Mining Industry

New models of the Massco-Grigsby Pinch Valve incorporates several improvements according to the manufacturer, The Mine and Smelter Supply Co., 3800 Race St., Denver, Colorado. The valve, used for handling abrasive and corrosive pulps and liquids, is available with either rubber or neoprene sleeves in sizes from one inch to 14 inches inside diameter for pressures to 150 psi and temperatures to 200 degrees.

A new feature is the Hydral-Air operating mechanism for easy, fast closing of the valve. Consisting of an air-hydraulic pump, the unit can be installed as a centralized mechanism for operating several valves, either manually or automatically. Write manufacturer at the above address for additional information. Use handy reader service card.



Automatic Water Control Featured by G-D Stoper

A new stoper which, according to the manufacturer, is designed to increase drilling speed and hanndling ease has recently been announced by Gardner-Denver Company, Quincy, Illinois. Called the R68, this new stoper features the "water on—air on; air off—water off" control system. Available with push-button or rotary-type feed controls, the R68 is equipped with automatic blowing through the chuck end, and is available with either collared or tappet chuck. Aluminum feed legs, either direct or telescopic feed are supplied with the new stoper. Use reader service card to write company for further information.

MINING CATALOG: Lake Shore, Inc., Iron Mountain, Michigan has made available a new 16-page bulletin covering their latest models of mine cars, car dumpers, sheaves, skips, cages, hoists and other Lake Shore products. Details of products are clearly shown. For your copy circle No. 1.

SELECTING POWER FOR PUMPING is a new 12-page power selection handbook recently released by the Caterpillar Tractor Co. This booklet is especially designed to be useful to those who have a pumping operation. For your copy write to the company in Peoria, Illinois.

RUGGED MINING CABLE is the topic of a new brochure released by Columbia Geneva Steel Div., United States Steel, on their Amercland flat-twin mining machine cable. The toughly covered cables are designed to minimize twisting, and feature high tensile strength, resistance to abrasion, tear, and compression cutting resistance. Write to the company at 120 Montgomery St., San Francisco 6, Cal., for your copy.

OPERATOR'S MANUALS: Eimco Corporation, 634 South Fourth West, Salt Lake City, Utah, announces two new manuals for operators of Eimco Model 105 Tractors; the Eimco Tractor-Excavator, and the Eimco Model 105 Front End Loader. Write to the company for your copy.

POTENTIAL HAZARD of radio-frequency energy to blasting operations is explained in a new booklet available from the Explosives Development Section, Atlas Powder Co., Wilmington 99, Delaware. The booklet explains in simple terms the nature of the hazard and offers precautions designed to minimize it. Write to the company for your free copy.

NEW GROUND EM UNIT: The Rooks Ground EM unit, used to outline and detail sulphide ore bodies detected by airborne methods, has been developed by Hunting Associates Ltd. According to the company, this two man unit can be used to survey up to five miles of picket line per day by inexperienced operators. Circle No. 3 for additional information.

SWECO ON HMS PLANTS: Southwestern Engineering Company has just issued a new technical bulletin describing its Factory Built Heavy Media Separation Plants. The bulletin presents a basic discussion on HMS Separation principle and its application with SWECO plants. Write the company at 4800 Sante Fe Ave., Los Angeles 58, California, for your copy.

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RADON CONTROL: A report describing methods of measuring and controlling atmospheric concentrations of radon and daughter products in uranium mines has been recently released by the Public Health Service. For a copy of this informative report (Public Health Service Publication No. 494) write to Occupational Health Program of the Public Health Service, U.S. Department of Health, Education and Welfare, Washington 25, D.C.

POWER IN ACTION is the title of a new 64-page brochure published by the International Harvester Co. This interesting booklet tells the story of IH earthmoving equipment in action. Write to the company at 180 North Michigan Ave., Chicago 1, Illinois, for your copy.

DIESEL-ENGINE COMPRESSORS: Ingersoll-Rand Company have recently released a new brochure on their new line of integrally-built four-cycle SVO Diesel-engine compressors. The SVO is a heavy-duty machine, combining a four-cycle V-angle Diesel engine and a double-acting compressor into a single compact unit. Write to the company at 11 Broadway, New York 4, N.Y. for your copy.

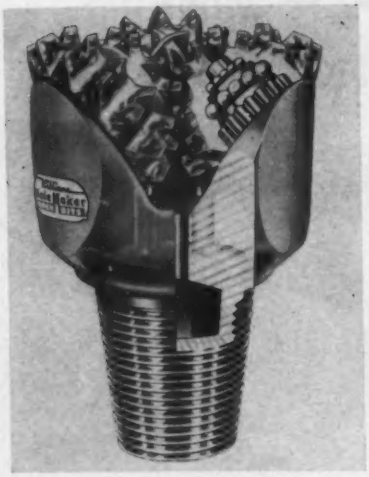
CONVEYOR BELT SERVICE: Based on successful experience in the Mesabi Range, a new national service for repairing and rebuilding large conveyor belts has been announced by Conveyor Belt Service Co. According to the company belts costing $5.00 to $100.00 per foot have been successfully rebuilt. Circle No. 19 for free booklet describing service.

WIRE ROPE RECOMMENDATIONS is the title of a new booklet by the Hazard Wire Rope Division, American Chain & Cable Co., Inc. Besides describing the manufacturer's full line of rope products, useful information is contained in bulletin DH-129-B regarding types of rope, diameters, functions, etc. Circle No. 20 for your copy.

FACTS ON EXPLOSIVES: Facts and figures to help users of explosives, as well as descriptions of the company's complete line of explosive products, are included in a new edition of its 48-page catalog just published by Atlas Powder Co. Use handy post card to write company at Wilmington 99, Delaware.

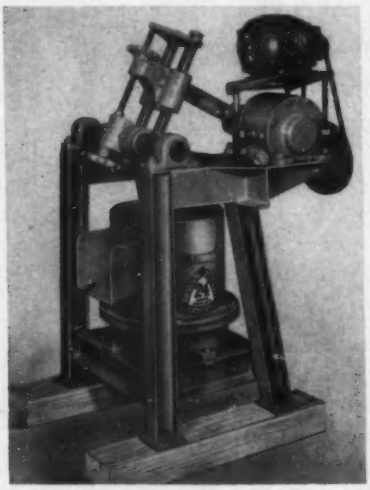
ELECTRONIC SEPARATION: A four-page technical paper on high voltage and magnetic separation is now available from Carpco Research & Engineering, Box 3272, Jacksonville, Florida. The article covers electrostatic and electrodynamic high voltage separation and both low and high intensity magnetic separation. Write to the company for your copy.

List information you want MINING WORLD to obtain for you on this card. WE'LL DO THE REST. NO postage necessary if mailed in U. S.



HoleMaker Rock Bits In Four New Designs

The Oil Tool Manufacturing Company announces HoleMaker rock bits in four new designs. These are in addition to their line of 13 different designs engineered for rotary drilling in all formations from soft to extremely hard. The HoleMaker and "K" Bits are made in a complete range of 14 sizes from 3¾-inches to 7⅞-inches and are designed with jet action for both air and water drilling, machined to exacting tolerances. Elimination of thrust loads on roller bearings thoroughly reduces the forces which tend to slant rollers in the races. For further information circle No. 60.

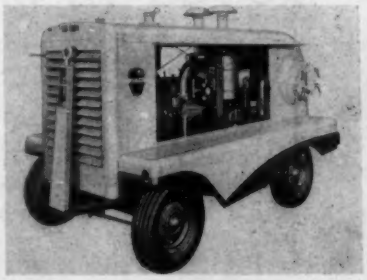


75% Higher Capacity With New DECO Pump

Denver Equipment Company has announced production of a new four-inch Adjustable Stroke Diaphragm Pump which makes possible a longer stroke and up to 75% higher capacity. Adjustment can be made while pump is operating. Space requirements have been reduced for easier installation and maintenance. The unit is only 50-inches high. Lower horsepower is required because antifriction bearing design practically eliminates friction and reduces maintenance. Capacity of the pump is up to 70 GPM for simplex and 140 GPM for duplex, at a horsepower of ¾ to 1 depending on specific gravity of pulp. Write the company at P.O. Box 5268, Denver 17, Colorado, with reader service card.

Airborne Laboratory by Aero Service Corporation

An airborne laboratory, contained in a Sikorsky S-55 helicopter, is now being used by Aero Service Corporation, in its world wide hunt for additional ore deposits. The aircraft is equipped with three separate detecting instruments. A magnetometer seeks out ores as iron, ilmenite and nickel. An electromagnetic detector finds electrically conducting sulphides of lead, zinc and copper, while a scintillation counter responds to uranium, thorium and other radioactive elements. All findings are recorded on a Brush Electronics Company direct writing oscillograph, which instantaneously charts minute variations in the signals received from the detecting instruments. Write to the Brush Co. at 3405 Perkins Ave., Cleveland 14, Ohio, for further information.



New Lightweight Rotary Compressor by Le Roi

The manufacture of a light, short turning, portable 600 cfm rotary air compressor, has been announced by the Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

The Le Roi 600D2 is the first of a new line of rotary air compressors. It is a portable, two-stage, sliding vane type rotary, and is rated at a free air capacity of 600 cfm. Dry weight is 7,730 pounds, and it has a turning radius of only 11-feet, 11-inches. The unit is coupled to a GM-71 Diesel engine with a hydraulically activated clutch. By use of an automatic variable capacity regulator and an automatic governor speed control, engine speed varies to match air demands. For additional information, write the company using reader service card.

how STANDARD HERSEY TEST DRYING can save you money!

Standard Steel Corporation offers its complete "Pilot" drying facilities to customers and prospective customers. Standard-Hersey test dryers, like the one illustrated below, can be adjusted to duplicate the performance of any type rotary dryer. You learn in advance the exact requirements for your individual dryer application. This eliminates guesswork and in nearly all cases results in substantial savings in your ultimate dryer installation.

Write TODAY for bulletin on "pilot" drying and the more than 30 types of Standard-Hersey dryers for the process industries.

STANDARD STEEL CORPORATION
General Offices and Factory, 5031 Boyle Avenue, Los Angeles 58, Calif.

LEADER IRON WORKS
Midwest Offices and Factory, Decatur 31, Illinois
ROTARY DRYERS • KILNS • COOLERS • ASPHALT PLANTS

HOW ST. PATRICK'S COPPER MINE MOVES 1⅓ MILLION TONS OF ROCK A YEAR

ON ITS WAY OUT OF THIS MINE, a huge Caterpillar DW21 Wheel Tractor stops to have its picture taken—for here it is helping to make mining history.

At St. Patrick's Mine near the village of Avoca in County Wicklow, Ireland, four 30-ton units are operating *underground*—first machines of their size ever to do so, anywhere in the world.

The machines are CAT* DW21s (Series C). They're hauling earth and rock from inside the mine tunnel to an outside dumping area. The tunnel is 17 ft. high, 16 ft. wide, and when it is finished it will run 8,000 ft. at an 11% slope. In and out of this tunnel roll the mighty DW21s, each hauling an Athey PR21 rubber-tired rear dump trailer with 34-ton load.

When the haulage-way is completed, St. Patrick's will work three ore bodies—which are at different levels—in one 20-year program. 1⅓ million tons of rock will come out of the ground here each year, on the fast-moving wheels of St. Patrick's 300 HP (maximum output) Caterpillar DW21 Wheel Tractors.

How are the DW21s doing on this history-making assignment? "They are easy to handle," reports transport foreman Phelim Doyle. "I would like to have ten more." Operator Thomas Doyle agrees: "It's easy to steer, and it has plenty of power."

Your Caterpillar Dealer will give you complete information on this remarkable unit. For example, special exhaust scrubbers are available for the DW21's engine for underground work. Ask him about its performance on any kind of stripping or hauling job. Call on him, too, for expert service—and for replacement parts you can trust.

Caterpillar Tractor Co., San Francisco, Calif.; Peoria, Ill., U.S.A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

ONE GOAL: To concentrate our capabilities, resources and experience on the design, manufacture, distribution and service of job-tested heavy equipment.

outside

high-pressure and high-temperature molding for extra

LAMINATED PROTECTION

Laminated construction means M-S-A Skullgard protection is built-in, layer by layer. More than 6 different materials, blended to provide maximum strength without excessive weight, are used. This method of exactly positioning the reinforcing pieces for maximum safeguard led to the development of the M-S-A "Danger Zone" protection. But that's only part of the protection story. To make sure these material layers are *permanently welded*, more than 2000 pounds of pressure, and carefully controlled heat, are used in our molding process. The result is a one-piece, smooth, laminated shell that gives workers an extra margin of safety.

inside

...quality design and material selection for added

SAFETY-COMFORT

M-S-A Skullgard suspensions are designed to provide maximum protection, better distribution of impact. Crown straps are of high quality material selected for strength, comfort and durability. The entire suspension assemblies are tailored for top comfort. Available in Snap-in Adjustable type, Standard Sized Laced type, and Adjustable Laced type.

with M-S-A® SKULLGARDS

Small wonder M-S-A Skullgards are turning head accidents into incidents in a variety of industries. Tough, rugged, *laminated* shell construction dissipates the force of impact—engineered suspensions cushion the blow, permit non-slipping adjustment that means accurate fit. And comfort qualities encourage full-time hat use. Our bulletin gives complete details. Write for your copy.

The complete line of head protection available from M-S-A also includes Glass Fiber Hats in eight stock colors, and Aluminum Hats and Caps.

MSA

SAFETY EQUIPMENT HEADQUARTERS

When you have a safety problem, M-S-A is at your service
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Power shovel breaks down . . .

So quarry moves boulders with

All over the country, more and more dirtmovers are finding Michigan Tractor Shovels can effectively handle jobs once considered much too tough for rubber-tired equipment.

You've probably read about—or seen—Michigans digging pit-run gravel. Or breaking out reinforced concrete. Or clearing brush. Now here's another dramatic application.

Maintains pit production

The company involved, a large northeastern firm, had always had trouble maintaining pit production when any of their big power shovels broke down. One time this happened, they had a Michigan Tractor Shovel in the pit on demonstration. They decided to put it through the rugged test of rock loading.

Now own six Michigans

That was in 1954. Today, this company owns *six Michigan Tractor Shovels!* In emergencies these units effectively handle both rock loading and cleanup. They also handle *all* truck-loading of screened aggregates and other products of the multi-million-ton crushed stone plant. Management estimates their output "definitely greater" than output of loaders formerly used. Maintenance costs, over periods ranging up to three years, have been "satisfactorily low".

Boulders weigh up to 7 tons each

Note the photos. Above, one of the company's five 2¾ yard Michigan Model 175A's is moving huge boulders to stockpile for later sale as rip-rap. Each chunk weighs ½ to 7 tons . . . yet at no time has operator reported trouble handling them. Upper right, another Model 175A loads shot rock at the quarry face. Michigans' unobstructed dumping height, power shift, and power steer helps speed both emergency assignments.

Load 10 tons in 2 to 3 minutes

Stockpile loading (lower right) keeps the company's

This is the type of shot rock that must be loaded into trucks for transport to crushers. Michigan Tractor Shovels must be able to take a lot of punishment—and they do!

A full bucket every time saves trips, cuts handling costs of loading crushed stone or sand. This load weighed out at 7,000 lbs. This model Michigan can lift 15,000 lbs.

2¾ yard Michigan

2 yard Model 125A and most of the 2¾ yard Model 175A's busy most of the time. Good mobility and unexcelled breakout, *equally great* through the entire lifting arc, make quick work of this job. The Model 125A needs only 3 minutes to heap a typical 10 yard truck . . . the bigger Model 175A's require only 2 to 2½ minutes.

24 mph travel speeds odd jobs

Michigan speed pays off on odd jobs, too. Like cleanup of haul roads, stockpiles, and around crushers. Pushing loaded trucks up grade. Setting utility poles. Hoisting crusher screens and other heavy equipment. Switching railroad cars (up to 25 empties at once). Plowing and removing snow. Despite year-around work averaging 50 hours a week, company officials report "downtime negligible." And continuing, "The all-Clark-built, all-matched power train sure boosts efficiency. From power shift, power steer and 3-to-1 torque converter to planetary wheel drive axles . . . our '54 model has the same components as our newest rig . . . which certainly proves how good the Clark design is. We like the speed of loading . . . the speed between job sites . . . the excellent performance on emergency rock-handling . . . the lack of downtime . . . the ease of maintenance. That's why we've been repeat-buyers five times!"

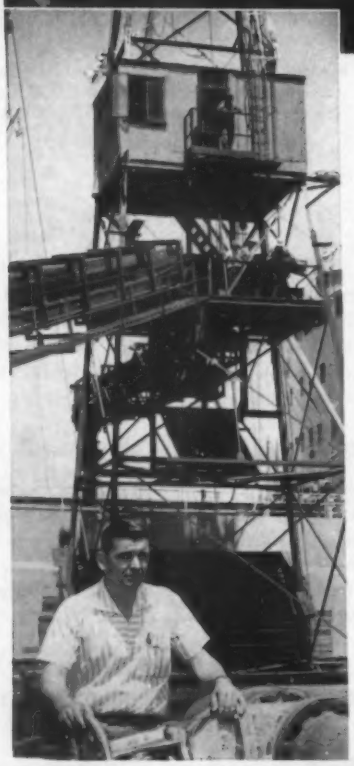
Make your own test

A demonstration, gladly arranged by your local Michigan Distributor, will show you why you too should be a Michigan Tractor Shovel buyer. Put the demonstrator on your toughest loading jobs . . . we'll bet *our cost* of the demonstration *against your time* you'll really be *enthusiastic* about the results.

Michigan is a registered trade-mark of

CLARK® EQUIPMENT

CLARK EQUIPMENT COMPANY
Construction Machinery Division
2493 Pipestone Road
Benton Harbor 42, Michigan
In Canada: Canadian Clark, Ltd., St. Thomas, Ontario



UNOBA GREASE

...cut lubrication costs 50% at Stockton Bulk Terminal

Stockton Bulk Terminal Co. reports switching to UNOBA GREASE on conveyor roll bearings cut maintenance interval and lubrication costs approximately 50%.

During the 3½ years that UNOBA has lubricated these critical parts, this grease has never failed under extreme conditions of high speeds, heavy bearing loads, and dense abrasive dust. The only bearing replacements have been due to mechanical, never lubrication failure.

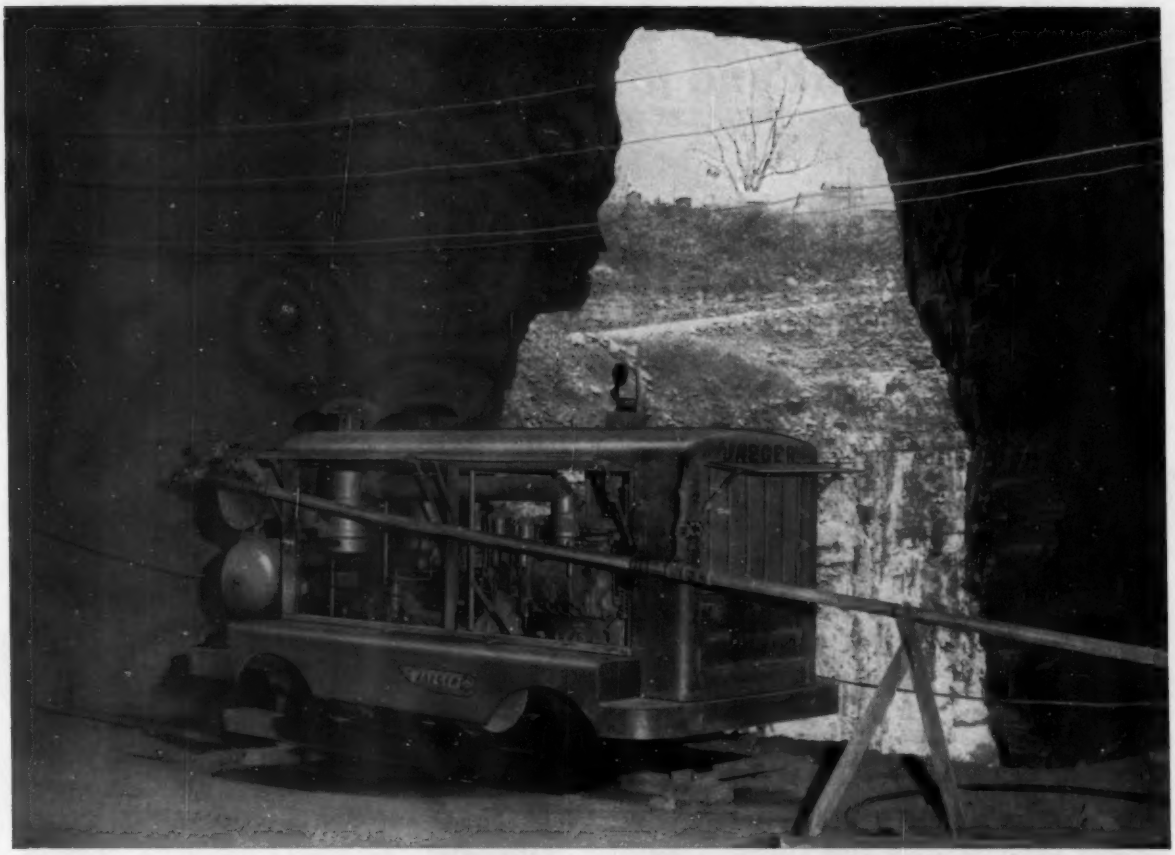
The Stockton Bulk Terminal Co., rated as the most efficient as well as largest bulk facility on the coast, can load ore at the rate of 1,000 long tons per hour around the clock. In 1956 it loaded in excess of 1,200,000 long tons onto vessels calling at the Port of Stockton, 75 nautical miles east of San Francisco Bay.

As this report attests, proper maintenance with Union Oil lubricants plays an important part in this high-speed bulk loading operation, as it can in yours. Try UNOBA GREASE and Union's other heavy-duty industrial lubricants. You'll be convinced—they are the finest.

UNION OIL COMPANY
OF CALIFORNIA

76

Los Angeles: *Union Oil Bldg.* • ***New York:*** *45 Rockefeller Plaza* • ***Chicago:*** *1605 Bankers Bldg* • ***Boston:*** *214 Harvard Avenue* • ***Kansas City, Mo.:*** *612 W. 47th St.* • ***Philadelphia:*** *No. One Wynnewood Rd., Wynnewood, Pa.* • ***Dallas:*** *Fidelity Union Life Bldg.* • ***New Orleans:*** *644 Nat'l Bank of Commerce Bldg.* ***Atlanta:*** *1401 Peachtree St.*



400 FT. (IN 12-18 FT. DEPTHS) PER 8-HOUR SHIFT, IN HARD MISSOURI LIMESTONE, ON 36 GALLONS OF FUEL

This is average day's work of this Jaeger "600" Rotary Compressor and two 4" drifters, in Federal Materials Company's underground quarry at Cape Girardeau, Missouri. A. W. Zimmer, Jr., Secretary-Treasurer and Manager, reports: "We are more than 100% satisfied with the performance of the Jaeger rotary compressor. Efficiency and fuel economy are remarkable and, except for regular filter changes, maintenance expense has been zero."

Jaeger 600 Rotary ...*brings new efficiency to drilling*

A Jaeger "600" rotary produces the same 600 cfm of air as other "600" compressors, *using the same 6-71 GM diesel engine at 100 to 150 rpm slower speed (1650 rpm instead of 1750 or 1800).*

This explains why Federal Materials Company can keep two 4" drifters drilling 8 hours in hard rock on only 36 gallons of fuel. You use less fuel, subject your engine to less wear, and turn your compressor as many as 9000 fewer revolutions every hour you work.

Smaller Jaeger Roto Air Plus® units have the same low speed, high efficiency performance. It will pay you to get full details or demonstration from your Jaeger distributor —or let us mail you Catalog JCR-5.

CRAWLER AND BOOM MOUNTINGS for both 4" drifters was designed by Federal Materials Co. to fit their particular needs.

50th year JAEGER CONSTRUCTION EQUIPMENT

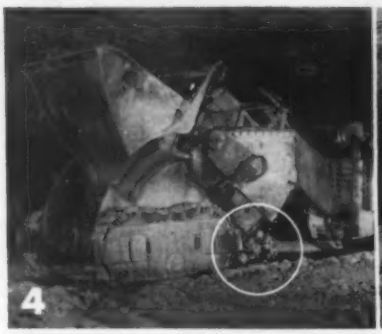
THE JAEGER MACHINE COMPANY

667 Dublin Avenue, Columbus 16, Ohio

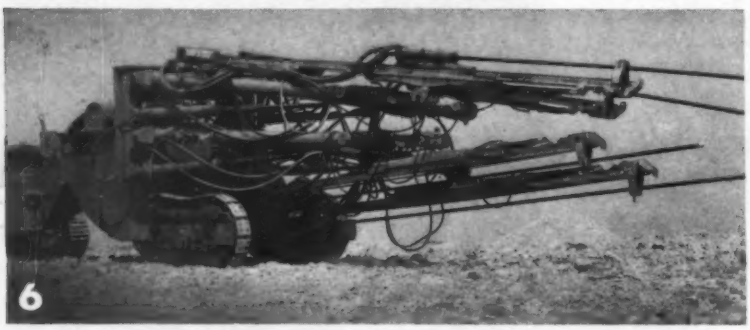
PUMPS • CONCRETE MIXERS • SPREADERS • FINISHERS • TRUCK MIXERS

How Simple Gismo® Equipment cuts manpower in development and production work...

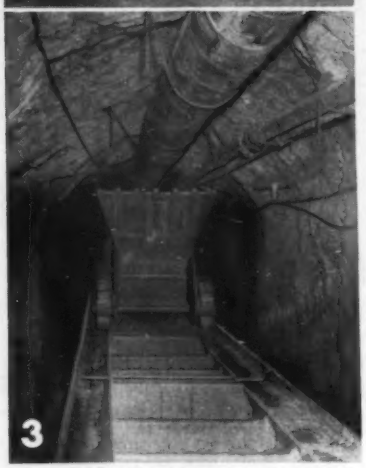
MINIMUM AMOUNT of equipment in stopes automatically reduces manpower to the minimum. Gismo unit consists of 4-drill jumbo and S-D Gismo Self-Loading mucking transport. Two men operate 4-drill jumbo; one man operates Gismo in the mucking operation.



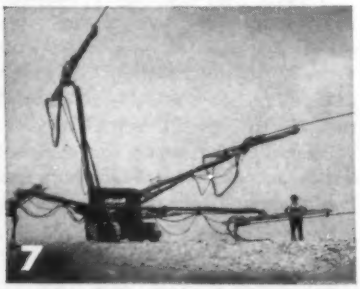
IN PRODUCTION or stope-work Gismo transports its loads and dumps directly into storage bin or ore pass as shown above, or ramping over present haulage equipment if haulage is now in ore bed. Same S-D Automatic Cars used for development work are used for haulage transportation from ore passes to hoisting facilities.



SAME GISMO mucking power unit is used to move 4-drill jumbo to new stope face or in development heading. (See Photo 6 above.) During drilling cycle in stope-work the Gismo power unit is used with mucking transport. Note in Photo 7 at right the reach of the 4-drill jumbo.



IN DEVELOPMENT Gismo loads directly into S-D Automatic Cars. (See Photos 2 and 3 above.) Two men operate 4-drill jumbo; one man operates Gismo and one man operates locomotive in car haulage.



As in all mechanization programs, proper supervision and maintenance programs should be set up. You may obtain complete information by writing ***Sanford-Day Iron Works, Inc., Knoxville, Tenn.***

SANFORD-DAY

KNOXVILLE, TENNESSEE

For drifters, sinkers and stopers . . .

New TIMKEN® threaded carbide bit

Has 5 new features to lower your cost per foot-of-hole

5 front holes clear chips faster. Water shoots directly forward with more velocity against the face, washing chips to the rear faster. Center plug is dropped deeper for freer cutting action, less drag. New frontal design *cuts your cost per foot-of-hole.*

Deeper, wider clearance between the wings works with five front holes to speed chip removal. Extra clearance permits water to carry chips away faster from the cutting face. Faster chip flow speeds drilling, increases efficiency. You get *lower cost per foot-of-hole.*

Deeper undercut under the heel provides even freer passage for washed-back chips. It reduces bit drag, increases bit life. This new feature, plus redesigned heavier wing, helps speed your drilling, *lowers your cost per foot-of-hole.*

Wear-resistant carbides give the new Timken® bit longer life. These special analysis carbides resist wear better, provide added shock-resistance. They can be reconditioned many times. Bit gives longer service life, you get *lower cost per foot-of-hole.*

Improved thread contact reduces breakage. You get longer bit life, *lower cost per foot-of-hole.* Write today for free brochure. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable: "TIMROSCO".

THERE'S A TIMKEN BIT FOR EVERY JOB . . . EVERY DRILLING CONDITION

TIMKEN MULTI-USE BIT

With correct, controlled reconditioning, gives lowest cost per foot-of-hole when full increments of steel are used.

NEW TIMKEN TAPERED SOCKET BIT

For air-leg drills and light stoping. Removable for full steel life, tapered for more secure union. Same new frontal features as threaded bit.

TIMKEN TRADE-MARK REG. U. S. PAT. OFF. ***REMOVABLE ROCK BITS***

See the first Timken Televent hour, in color, "Eleven against the ice—story of the Antarctica Turnpike". NBC-TV, Monday night, Sept. 23.

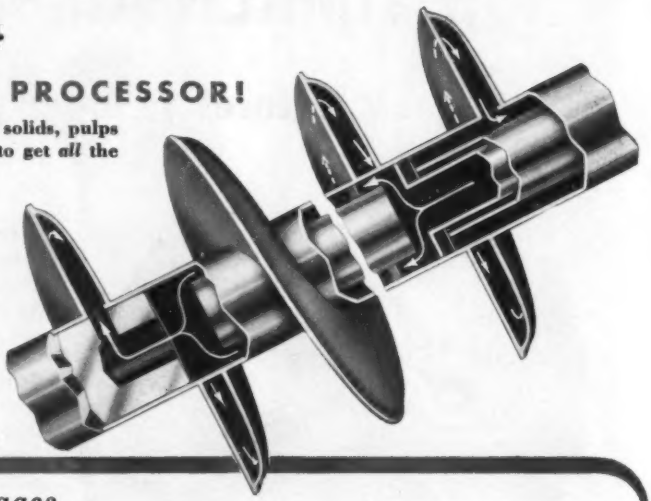
if you have a Cooling...Heating...or Drying problem

investigate the revolutionary advantages of...

THE holo-flite* PROCESSOR!

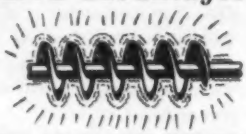
If you have processes where slurries, granular solids, pulps or pastes are cooled, heated or dried, be sure to get *all* the facts on HOLO-FLITE advantages.

HOLO-FLITE handles such processes — *in continuous flow* — in as little as 1/5th the space of other types of heat exchangers. What's more, it is readily adaptable to a wide range of applications — is simple to install and maintain — and provides many other important savings.

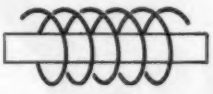


typical HOLO-FLITE *advantages...*

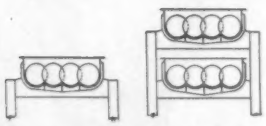
ITS APPLICATION FLEXIBILITY is almost unlimited. It cools, heats, or dries. It handles granular solids, pulps, pastes, slurries and fluids with equal ease. Its heat transfer agent can be water, refrigerant, hot oil, Dowtherm, steam or other liquids or vapors at any of a wide range of temperatures. It cools materials in ranges from 1800°F to 0°F. It heats and dries with hot oil to 600°F...with Dowtherm to 750°F...with steam to 150 lbs. per sq. in. pressure.



THE LARGE HEAT-TRANSFER SURFACE saves space — HOLO-FLITE requires as little as 1/5th the space of other heat-exchange equipment of comparable capacity. Moreover, a more complete heat transfer is effected, resulting in more uniform processing.



ROTATION IS SLOW — granular and powdered solids are handled with practically no dusting — negligible abrasion. There are no dust recovery problems — a further saving in installation, maintenance and operating costs!



ITS OPERATING CAPACITY is readily adaptable to virtually any requirements by simply varying the diameter, pitch, and length of flights, as well as the number of "tiers." Multi-tier units require no more floor space than single-tier installations!

Send for a Free 8 Page Bulletin which gives further time, space and money-saving details on Holo-Flite installation and operating advantages!

*T.M. Reg. (HOLO-FLITE)

HOW HOLO-FLITE WORKS...

Basically the HOLO-FLITE consists of one or more flights of hollow-bladed screw conveyors. The product to be processed moves through a trough housing the conveyor screws. The heat-transfer fluid circulates through the hollow blades and shafts of the conveyor. The product is constantly rotated into, around, under and over the blades and shafts through which the heat-transfer fluid is circulating, assuring quick, uniform heat passage between the two mediums — *as the product is continuously moved along in a bulk-flow without interruptions!*

There are many money and time-saving applications for the Holo-Flite wherever products are cooled, dried, heated or even calcined. Let our engineers study your *particular* problem and make helpful recommendations. No obligation, of course!

COTTRELL Electrical Precipitators
MULTICLONE Mechanical Collectors
CMP Combination Units
DUALAIRE Reverse-Jet Filters
HOLO-FLITE Processors
HI-TURBIANT Heaters

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Engineers and Constructors of Equipment for Collection of Suspended Material from Gases . . . and Equipment for the Process Industries

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Precipitation Company of Canada Ltd., Dominion Square Bldg., Montreal

Ura Mang Corporation's New Tennessee Mill Treats 500 Tons of Manganese Ore Daily

Eastern Tennessee has a new manganese producer. Since April Ura Mang Corporation has been mining and milling from 500 to 600 tons of ore per day in Unocoi County. Regular shipments of concentrates are made to the General Services Administration under the Carlot Purchase Program.

Ura Mang's headquarters are in Washington, D. C. where the largest stockholders reside. Officers of the Corporation are Harry Wendler, president; Sidney Spector, executive vice president; Troy Beaver, field vice president; David Goldberg, treasurer; and C. A. Levine, secretary.

Three open-pit mines are being developed; several other areas are being prospected in which other mines may be opened. Ore is hauled to a new mill in Horse Cove for washing and gravity concentration. The mill was built near the firm's largest mine where a dependable source of water was available.

Manganese ore is found in irregular pockets and masses in highly weathered Shady dolomite which has weathered to a red clay and red soil containing the manganese. In the open-pit mines, overburden and very low-grade mineralized clay is stripped with two Allis-Chalmers HD-11 front end loaders. The bucket is lowered for bulldozing work. For selective mining, waste is segregated and transported to the dump in the 2½-yard bucket. Ore pockets are loaded directly into trucks for transportation to the mill. To speed stripping, a 1½-yard dragline with a 70-foot boom is being purchased.

Milling requires two important steps: first to wash the barren clay and fine soil free of the coarser material (manganese and rock) and, second, to gravity separate the manganese minerals from rock.

It is not unusual to have sticky clay as 90 percent of mill feed, by volume. This must be removed by washing and scrubbing and immediately discarded as tailing. Ore is sluiced from the bin into a 5- by 11-foot revolving scrubber with internal lifter bars and high pressure water jets. Scrubber overflow passes over a circular grizzly with 2¾-inch openings on the end of the scrubber. The now muddy water flows through the grizzly to the tailing pond and the coarse material drops into a 25-foot double log washer where remaining clay balls are broken up. Washer overflow is tailing. The scrubber is very effective in breaking up clay and eliminates several log washers which normally are required for tonnage being treated.

Washer oversize is screened with the plus-¾-inch material going to a picking belt where coarse waste is removed by hand. Minus-¾-inch, plus-⅜-inch goes to three 2-cell 3-by 4-foot Harz jigs with double-center draw offs. Minus-⅜-inch, plus-¼-inch fraction is treated in two similar jigs. Minus-¼-inch middling from the second and third jig is crushed in a hammermill and recirculated to fine jigs. Identical jigs are used for coarse, medium, and fine sized feed but the length and speed of stroke are varied. On coarse jigs a 1¼-inch stroke at 140 per minute is used; for medium feed 1¼-inch stroke at 150 per minute; and for fine feed a 1-inch stroke at 160 per minute. Jig concentrate is dewatered by a small spiral above the concentrate bin. Concentrates are trucked to Irwin, Tennessee and loaded into railroad cars for shipment to GSA.

Power for the mill is generated by a GMC twin Diesel 200-kw, 220-volt, 425-ampere generator.

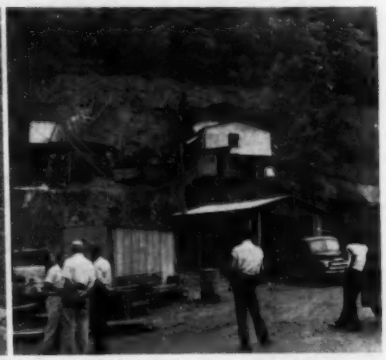
White Pine Copper Company has installed additional belt conveyors in its copper mine in Ontonagan County, Michigan and others may be installed as required. This will help to alleviate the long haul from the working faces to the underground crusher station. Research in mine methods and machines, together with geological interpretation, have indicated some necessary changes in mining plans. Some of these have been made and others will continue to be made as geological structural conditions require.

The Seventh Annual Drilling Symposium will be held at the University of Minnesota October 3, 4, and 5. It will be presented through the cooperative efforts of the School of Mines, the Center for Continuation Study, and the Mining Subsection of the Minnesota section of the AIME. Among the papers to be presented are: "Drill Hole Electromagnetic Exploration for Iron Ores" by Burton Boyum, chief geologist, *Cleveland Cliffs Iron Company*, Ishpeming, Michigan; "Drill Hole Electromagnetic Exploration for Sulphide Ores" by Philip G. Hallof, *McPhar Geophysics*, Toronto, Canada; "Comparison of Mining Grades with Estimated Grades—Non-Ferrous Ores" by Glen C. Waterman, Geologist, *Anaconda Company*, Salt Lake City, Utah; "Improvement of Core Recovery by Freezing Method" by Robert R. Carver, Manager, *Sprague and Henwood Inc.*, Scranton, Pennsylvania; "Collection of Samples by Vacuum Methods" by a representative of Hi-Vac Drilling Systems, *Houston Tool Company*, Santa Susanna, California; and "Sampling of Beach Sands" by Eugene V. Whittle, assistant technical superintendent, *Humphreys Gold Corporation*, Jacksonville, Florida.

The drop in lead and zinc prices has brought more production curtailments. Among the more recent: *New Jersey Zinc Company* has cut output of slab zinc at its smelters in Depue, Illinois and Palmerton, Pennsylvania; *U. S. Steel Corporation's Tennessee Coal & Iron Division* has reduced operations at the Jefferson City zinc mines and plants from a five-day week to a four-day week; *American Zinc, Lead & Smelting Company* is making further reductions of slab zinc output, bringing its total reduction to about 2,500 tons a month. The company is also curtailing its mining operations and development activities in the southern Wisconsin area, and will postpone bringing into production those new mines which have been under development.

Cerro de Pasco Corporation, in a move toward further diversification of operations, has acquired the assets and business of *Lewin-Mathes Company*, mid western manufacturer of copper and brass tube, pipe and rod. The firm has a plant at Monsanto, Illinois. At present production rates, Lewin-Mathes requires about 50,000,000 pounds of copper annually for its manufacturing processes, together with lesser amounts of lead and zinc.

Foote Mineral Company has been undertaking a $2,000,000 expansion of its manganese metal capacity at Knoxville,



URA MANG'S TENNESSEE OPERATIONS: at left ore is loaded at the Wilson mine, with stripping in the background. The operating staff, in center, are Sidney Spector, vice president; A. J. Lucas, engineer; Troy Beaver, vice president; and David Brettler, plant manager. Gravity mill, shown at far right, is built on a side mill in Horse Cove, Unocoi County.

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Tennessee with completion scheduled for the end of this year. It appears now that this new facility will go into operation earlier than anticipated.

W. R. Grace Company and *Pechiney*, the French chemical and metallurgical firm, have joined forces to produce a high-purity elemental silicon and other semiconductors. A new company will be formed by the two firms, and it will be under the direction of Grace's Davison Chemical Company division, already concerned with the production of other rare metals, such as thorium and uranium. A plant with an annual capacity of 20,000 pounds will be built for operation within 12 months. Location has not been revealed.

Stauffer Chemical Company has increased its research expenditure by $527,000, mainly for intensified process development with respect to titanium and boron compounds. The company's large boron trichloride plant recently completed at Niagara Falls, New York is based upon a unique process developed by extensive Stauffer research.

Haile Mines Inc. and Dr. M. D. Hassialis, Professor of Mineral Engineering and executive officer of the *Columbia University School of Mines*, have entered into an arrangement to develop new processes for treating low-grade refractory manganese ores, primarily for the steel industry. Similar research on processing rare earths and copper ores will follow.

Virginia-Carolina Chemical Corporation has decided that its uranium recovery plant was an uneconomical operation. The plant had been erected adjoining the phosphate facilities at Nichols, Florida, and was to recover uranium from the phosphate as a byproduct.

New Jersey Zinc Company has discontinued ore production at its *Sterling Hill* mine in Ogdensburg, New Jersey. Production from this mine is equivalent to 1,800 tons of zinc per month.

International Salt Company has been granted a contract to mine salt under Lake Erie off the shore at Cleveland, Ohio. A 50-year contract was signed between the company and the state of Ohio, which will pay the state a royalty of 5¢ per ton for any salt taken from the 5,193-acre tract in the so-called Whiskey Island area. The company reportedly plans to sink a 2,000-foot-deep shaft to produce crushed rock salt.

St. Joseph Lead Company has closed its plant at Moundsville, West Virginia which recovers zinc from residues. The prevailing low price of zinc has been the cause.

Haile Mines Inc. has acquired *Frank Samuel & Company* of Philadelphia, Pennsylvania, which will be operated as a wholly owned subsidiary. The firm is a mineral, metal, and chemical export-import firm and refractories manufacturer.

Lawson-United Feldspar and Minerals Company has opened its new plant at Minpro, North Carolina for refining of feldspar and other minerals from alaskite ore. The plant is equipped to produce 8,000 tons of glass grade feldspar, 2,500 tons of low iron and glass melting sand, and 400 tons of mica per 25-day month. Another unit for producing pottery, tile, enamel, and other ceramic feldspar is to be in production November 1. The company reports it has ample reserves which it owns or leases. The company is owned jointly by the Lawson family and *United Clay Mines Corporation*.

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International Minerals and Chemical Corporation, with mines and processing plants in Spruce Pine and Kona, North Carolina, has reduced the price of glass grade feldspar shipped from the area from $12.50 to $10.00. Glassmaker's nepheline syenite is now at $12.60 instead of $13.50.

Allied-Kennecott Titanium Corporation has selected Wilmington, North Carolina as the site for its plant to produce titanium forgings and billets. The site is a few miles outside of Wilmington, and consists of 1,500 acres with about two miles of frontage on the Cape Fear River. It offers low cost water transportation, a good supply of cooling water, and ample skilled labor. The installation will include a complete laboratory to carry on a program of reasearch and development for the new firm. Allied-Kennecott was formed earlier in the year by *Allied Chemical & Dye Corporation* and *Kennecott Copper Corporation*.

Kyanite Mining Corporation has completed its new plant at Willis Mountain, near Dillwyn, Virginia, and it is now in operation. The company now has three plants serving the ceramic industry. Kyanite Mining is the world's largest producer of domestic kyanite and mullite.

Rhude Media Company is now operating its new "cupola" furnace near Marble, Minnesota. The furnace is being used this season to furnish ingots from which ground ferrosilicon is made, but eventually the furnace will manufacture spherical ferrosilicon for use in heavy media plants on the Iron Range. A granulation method for direct disintegration of molten ferrosilicon has been developed by metallurgists at *Batelle Memorial Institute* at Columbus, Ohio. Granulation is achieved by the force of high pressure water and gas in fine streams through the molten material as it is poured from the furnace. Foreign use of spherical ferrosilicon indicates the ability to separate mineral from gangue at pulp gravities in excess of present ground ferrosilicon gravities.

Rescreening facilities at the Rouchleau crushing plant for the Eastern District of *Oliver Iron Mining Division, U. S. Steel Corporation*, have been placed in operation. The new facilities have a daily capacity of 33,000 gross tons and are the first step in the future development of "coarse" and "fine" ore shipment from the eastern end of Oliver operations. The ore is crushed to 4 inches and the entire crushed product goes into the new section of the plant for final sizing at ½ inch. The plus-½-inch material is loaded into cars for shipment to lower lake ports where it can be used directly in the steel furnaces. The minus-½-inch material will be sintered at the steel mills prior to entering the furnaces. The shipment of ore in these sizes improves steel making since the furnace burden is devoid of fine material. This "lumpy" ore permits the hot gases in the blast furnace to flow freely and thus reduces the burden to steel over a shorter period of time. In addition, flue dust losses are held at a minimum. Similar facilities are presently under construction at the Sherman screening plant for Oliver's Hibbing District. This construction is scheduled for operation in early fall 1957.

M. A. Hanna Company is now operating a small magnetite grinding plan at the Harrison plant in the Cooley district. The grinding plant was erected in order to obtain flexibility in the size of the media used in the cyclone sections of the heavy media plant which have to be varied to suit the various types of iron ore. The magnetite is dumped into a surge bin and then to a spiral classifier in which the coarse particles sink to the bottom. These coarse particles are then reground in a 4- by 5-foot ball mill and returned to the classifier for sizing. The fine magnetite which overflows the weir in the classifier is pumped into the cyclone circuit.

The latest estimate of iron ore reserves in the United States, made by the *United States Geological Survey*, has shown a total of 75,000,000,000 long tons of crude iron ore. This is an increase of 25,000,000,000 long tons since the last estimate of 1955. Some of the addition has come through further exploration and more complete information, but principally by the the inclusion of additional low-grade material in the Lake Superior area.

The total 1957 Lake Superior iron ore shipments through July 14 show 35,470,199 gross tons forwarded to lower lake ports. This represents an increase of 3,685,568 for a like date in 1956. It

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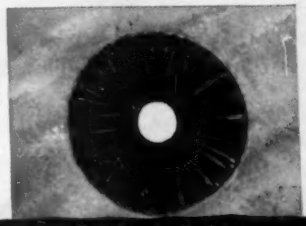

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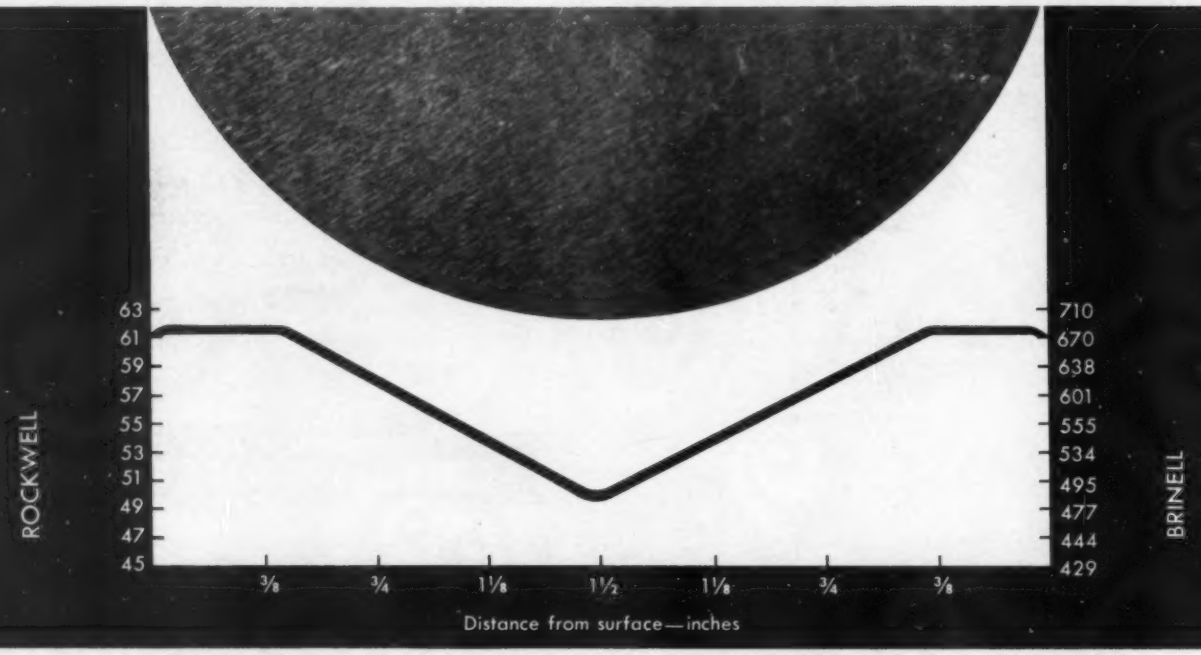

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should be noted, however, that during July in 1956, a nation-wide steel strike affected the cumulative total shipments.

M. A. Hanna Company has designated the *Norpac, Impro,* and *Pillsbury* mines on the Mesabi Iron Range near Hibbing, Minnesota as the *Pierce Group,* in honor of H. L. (Roy) Pierce. The Pillsbury has also been renamed the *Roy.* Mr. Pierce has been with the firm since 1906, and is presently doing consulting work for it, in addition to being chairman of the board of *Hanna Nickel Smelting Company.* He is responsible for the development and bringing into production of many of the iron mines operating today.

Sunset Mines, Inc. is carrying on an exploration project at its property in the Pine Creek zinc district near Kellogg, Shoshone County, Idaho. Lessees have been mining ore on a small scale. C. B. Merritt, Seattle, is secretary.

Hecla Mining Company of Wallace, Idaho has moved its exploration headquarters to the Fidelity Building, Spokane, Wash. The staff consists of Herbert E. Harper, Hecla chief geologists, and James J. Quinlan.

A new vein containing good lead ore has been found by the *Bunker Hill Company* in a previously unexplored portion of Bunker ground near Kellogg, Shoshone County, Idaho. The vein was discovered in driving an exploration tunnel to explore at greater depth the old *Senator Stewart* mine now owned by *Silver Bowl, Inc.*

Hall Mountain Thorite Mining Company has leased five claims adjoining its holdings on Hall Mountain near Porthill, Boundary County, Idaho. The company is carrying out intermittent exploration of a thorium vein. Bruce R. Berringer, Spokane, is president and manager.

About 2,000 tons of silver-copper ore is being produced monthly at the property of *Sunshine Consolidated, Inc.,* Shoshone County, Idaho. Stope ore has averaged about 35 ounces of silver per ton. Exploratory work has been resumed westward at a depth of 3,400 feet by the operating firm, *Sunshine Mining Company.* Norman M. Smith, Kellogg, is manager.

Silver values have been running higher than expected on the new bottom 4,000-foot level of the *Silver Syndicate* mine, Coeur d'Alene mining region, Shoshone County, Idaho. Lead values also are higher than on the 3,850-foot level above, although the vein is somewhat narrower. The mine is operated by *Sunshine Mining Company* from its adjoining workings. Norman Smith, Kellogg, is general manager of Silver Syndicate, Inc.

The *Triumph* lead-silver-zinc mine in Blaine County, Idaho's Warm Springs district has been shut down because of low prices for base metals. The closure followed a previous reduction of nearly half the 111-man work force. *Triumph Mining Company* is the owner, and L. M. Robinson is general manager.

Construction of a $750,000 pilot plant for processing clay in the Bovill area of Latah County, Idaho is scheduled to be

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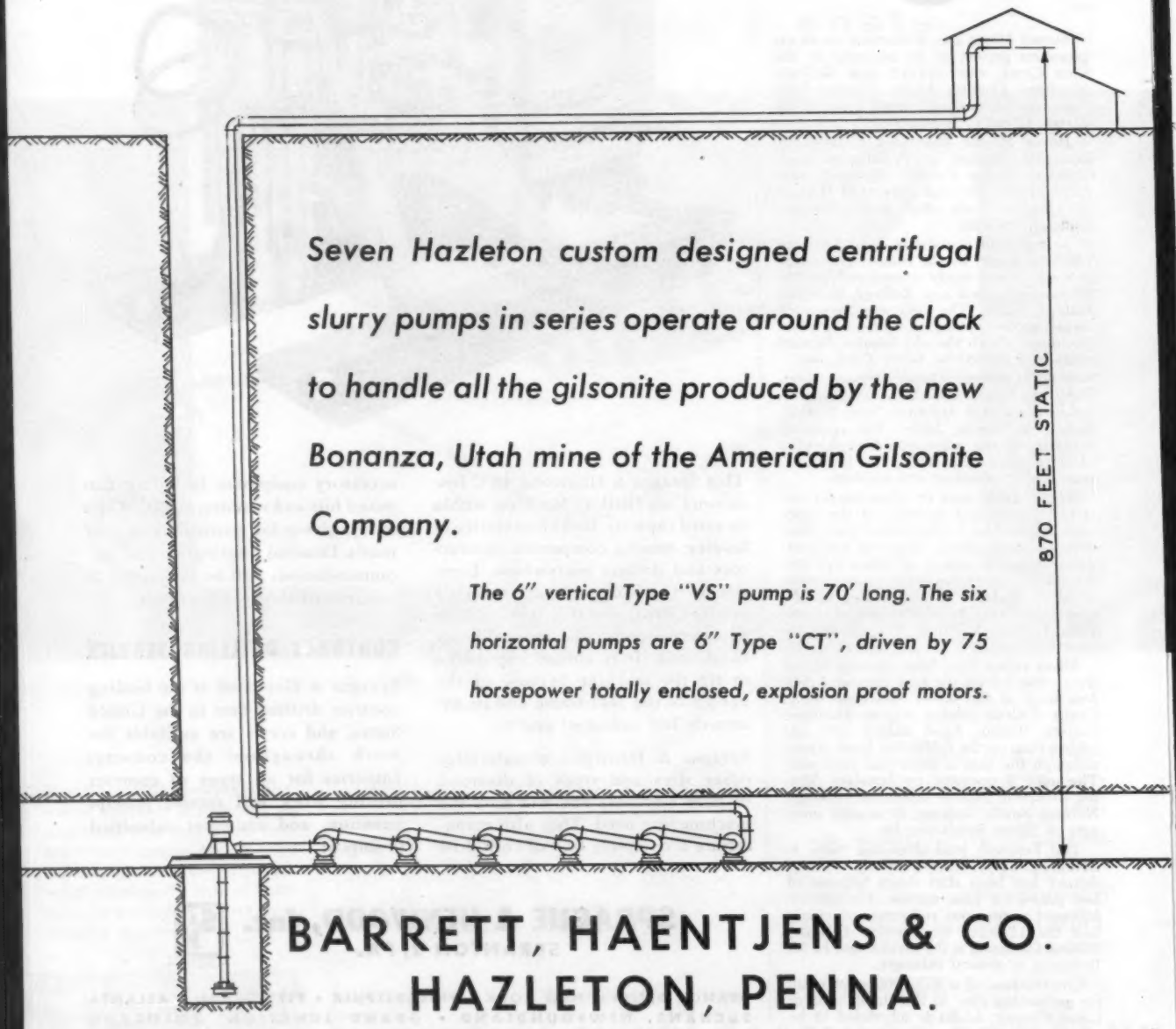

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started next June by *J. R. Simplot Company* of Boise. Charles W. Sweetwood, assistant manager of the firm's exploration division, recently looked over possible sites near Bovill.

Western Fluorite Mining Company, Inc., at last report, was preparing to ship uranium ore from the *Little Bill* property near Stanley, in central Idaho's primitive area. H. S. Childs is general manager.

Approval of a $10,000 fluorspar exploration project by *Squaw Creek Mining Company* at the *Smothers* property, Idaho County, Ihaho, has been given by the Defense Minerals Exploration Administration. The government agency will meet half the cost, repayable from production.

Black Bear Silver-Lead Mining Company has added to its Shoshone County, Idaho, holdings by leasing 15 claims from *American Smelting and Refining Company* and *Coeur d'Alene Syndicate. Metropolitan Mines Corporation* has been financing new development in the old Black Bear silver-lead mine on Canyon Creek north of Wallace. Some ore is being concentrated in the *Hull Lease* mill near Gem.

Failure of congress to appropriate money for tungsten purchases resulted in laying off half the 100-man crew at *Bradley Mining Co.'s Ima* mine in Lemhi County, Idaho.

Development of a lead-zinc ore body in the Pine Creek district of the Coeur d'Alene mining region, Shoshone County, Idaho, has been suspended by *Nabob Silver-Lead Mining Company* because of poor metal prices. Twenty men were employed. H. J. Hull of Wallace is president.

Radioactive black sands of the Elk City region are being investigated by a summer field party from the Idaho Bureau of Mines and Geology, headed by Professor R. R. Reid.

Cost of deepening the *Cresent* mine shaft, Shoshone County, an additional 2,000 feet was about $205 a foot for a total of some $410,000. The silver-copper mine is owned by *Bunker-Hill Company*.

Western Mica Corporation, recently organized in Deary, Idaho, has leased 155 acres of state-owned land in Latah County.

MONTANA

Midland Mining Company of Billings, Montana has obtained a Defense Minerals Exploration Administration loan of $20,256 on a $27,008 uranium exploration project at the *Sandra Group* mine in Carbon County. C. M. Hauptman is president.

Western Resources, Inc., Spokane, Washington, has made a public stock offering to raise $160,000 to finance additional exploration of autunite showings on the *Waterhole* group near Saltese, Mineral County, Montana. The Atomic Energy Commission drilled three diamond drill holes and drove a short adit in 1954. Since then the company has done considerable bulldozer stripping. Richard O. Batdorf is president; Allen R. Campbell vice president and general manager; Dean P. Methling, field manager.

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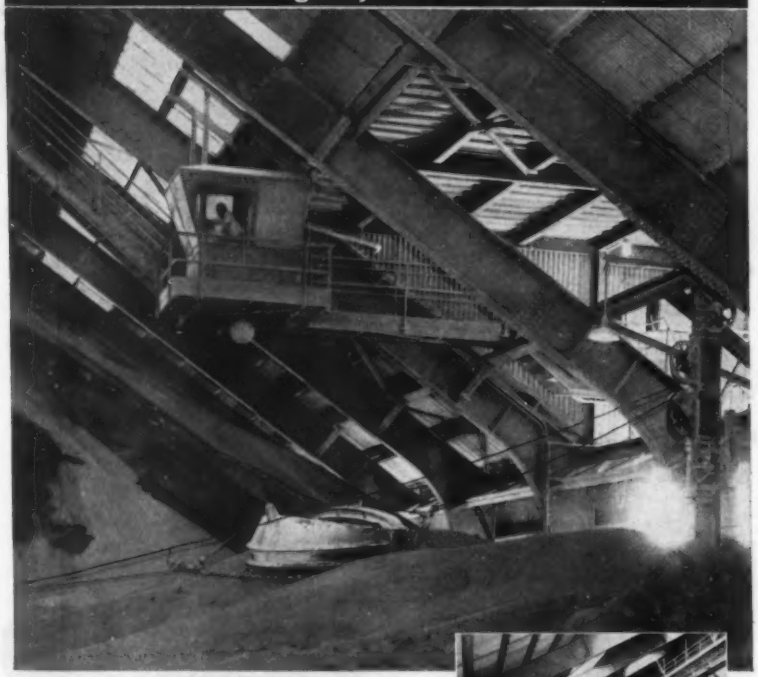

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NORTHWEST

A 5½ carat blue sapphire reportedly has been uncovered in the *Yogo* mine in Judith Basin County, Montana. A crew has been reopening the old mine since May. Approximately 6,000 tons of material is available to be processed, and a crew will continue to work on the old dump. Next year a mill may be erected. The mine is operated by *New Mine Sapphire Syndicate*. Last year Thomas P. Sidwell of Billings, and the *Commercial Uranium Mines* of Denver bought most of the stock in the syndicate.

Additional rehabilitation of old workings at a gold prospect on Rock Creek near Basin, Montana is being carried out to determine the source of high-grade uranium found on the mine dump. The project was started last fall by *Great Shield Uranium Mines, Ltd.*, Calgary, Canada. *Gold Syndicate Corporation* of Spokane, Washington has a one-fourth interest. William Inverarity is maager of the Canadian firm.

Montana Phosphate Products Company has resumed open-pit mining of phosphate rock near Garrison, Montana. *Utah Construction Company* has the contract.

E. E. Coleman, C. E. Vann, and V. C. Coleman of Helena, and D. E. Peck of Basin, have incorporated *Daily West Mines* of Helena, Montana with authorized capital of $50,000.

First gold shipment from Lewistown, Montana since 1943 has been made by Granville S. Abbott. It consisted of a gold bar weighing 68.35 ounces and valued at $2,400. It came from his *Black Bull* mine in the Judith Mountains.

H. R. Fleishman, Jr., J. T. Cornish, and R. S. Chamberlain of Hamilton, Montana have incorporated *Verilite Mines*, capitalization $250,000.

Three Bozeman, Montana men—T. G. McGrath, J. DeJardine and P. Strom—have incorporated *Minerals Exploration Development Company* with capitalization of $300,000.

OREGON

Operation of the *Haggard and New* chromite mine on Dog creek, Granite County, Oregon, has been taken over by William Gardner & Sons of Canyon City. They have stripped around old glory-hole workings preparatory to mining a lens of milling-grade ore. *Comstock Uranium-Tungsten Company, Inc.* operated the mine in 1956. Lessees have shipped more than $250,000 worth of ore in the last three years.

An exploratory tunnel is being driven at the old *Miller and Lane* property on Gold King Creek, Eagle Creek district, Baker County, Oregon, by John Allen and Ernie Craig of Richland. Ore minerals are mainly gold and copper sulphides. First operated about 80 years ago and again in 1912, the property had been shut down since a 1912 mill fire.

Molybdenum Corporation of America has examined a tungsten prospect on Pedro Mountain, Mormon Basin district, Baker County, Oregon. The owners are Joe Frisco and Jim Coleman.

Chemical Lime Company of Baker, Oregon is building a lime-burning plant

at Wingville, Baker County, and has completed a primary crusher at its Marble Mountain quarry.

WASHINGTON

A radioactive fault is being explored by drift at *Daybreak Uranium, Inc.*, in the Spokane Indian Reservation, Stevens County, Washington. Best values have been found in cross-faults. Some of the ore is greatly out of balance—assays have shown up to 60 percent more uranium than indicated by the amount of radioactivity present. James W. Fox, Opportunity, is president.

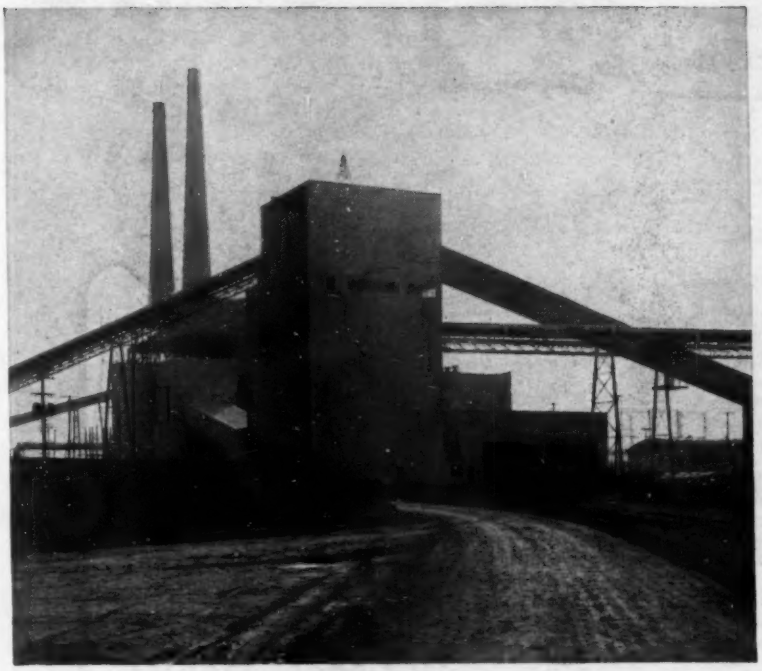
The No. 10 main shaft at the old *Gladstone* mine, northern Stevens County, Washington, is being deepened from the 200-foot point to 500 feet. The work is being done by A. G. Lotze who has the property under lease from *Gladstone Mountain Mining and Milling Company* of Spokane. He mined 385 tons of crude ore from another shaft in 1956 and resumed truck shipments to the Bunker Hill smelter at Kellogg, Idaho, in May after replacing shaft timbers destroyed by fire last October. Shipments have averaged about 70 percent lead. The best ran 81.1 percent. W. H. Swann, Spokane, is president of Gladstone.

A 1,000-ton ore bunker is now in use at the *Midnite* uranium mine in the Spokane Indian Reservation, Stevens County, Washington. Four wooden ore bins have been lined with steel plates because ore was hanging up on the sides. *Isbell Construction Company*, Reno, Nevada, is moving ore to the bins with seven 25-ton trucks under a contract with *Dawn Mining Company*, controlled by *Newmont Mining Corporation*. *Vic-Ore., Inc.* transports the bin ore 22 miles to Dawn's new $3,000,000 uranium processing plant at Ford. Pete Loncar is Dawn mine superintendent.

A primary type of uranium mineralization has been found in a granite shear zone in northern Lincoln County, Washington, across the Spokane River from the Spokane Indian Reservation uranium area. First radioactivity was found in a pit dug by early-day gold prospectors. At last report, *Old Frontier Uranium, Inc.* had opened the showing to a depth of 30 feet by means of bulldozer, wagon drilling, and blasting. Don Murphy of Eatonville, Washington is company president and manager.

American Smelting and Refining Company laid off 200 of its 1,200-man Tacoma smelter force following the closing of *Howe Sound Company's Holden* copper-gold-zinc mine in Chelan County, Washington and of the Copper Mountain, British Columbia operations of *Granby Consolidated Mining, Smelting and Power Company*.

The *Van Stone* open-pit zinc-lead mine of *American Smelting and Refining Company* near Northport, Stevens County, Washington, was shut down pending government improvement in base metal prices. About 65 men were laid off. Washington's largest zinc producer and third largest lead producer, the Van Stone was put into production late in 1952 at a cost of $2,000,000. The 1,000-ton mill



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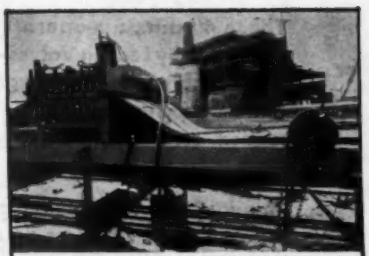
One of the largest in the U. S., this system depends on over 7,000 feet of Quaker Rubber belting to keep the coal moving.



To make sure 7,000 feet of Quaker Rubber conveyor belting (available in 48", 60" and 72" widths) was properly installed, splicing and vulcanizing of the belting was supervised by a Quaker Rubber specialist.

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SOLUTION: Quaker engineers and the Quaker distributor's men, working with engineers of the power plant, suggested the use of a belting designed for high lifts and long center distances. Over 7,000 feet was installed.

RESULT: The three conveyor systems work smoothly and efficiently, carrying coal into the plant at the rate of one million tons a year.

YOUR PROBLEM: Whatever your conveyor needs, whatever your industry—there's a Quaker Rubber Belt (or Hose) of the *right* construction to handle the job safely and economically. Quaker engineering service is available for the asking.

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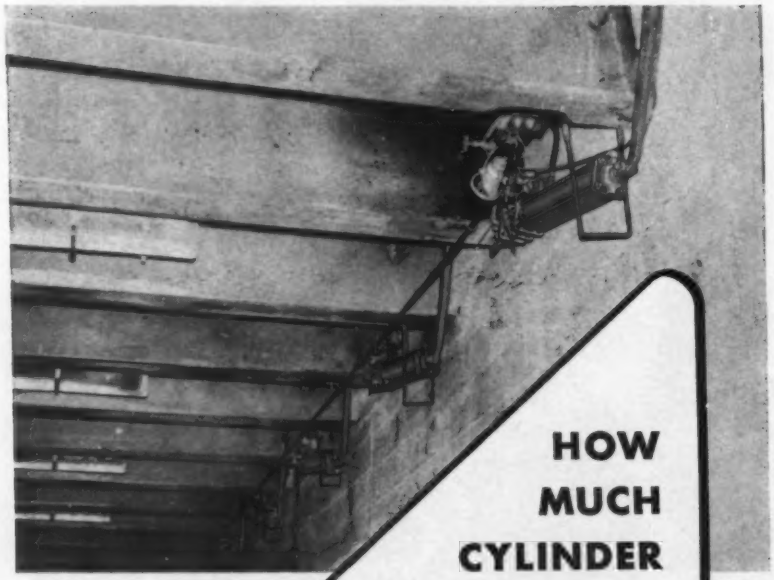

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These 4" dia., air-operated Ledeen Cylinders—remote-controlled by Ledeen Valves—speed the loading of ore trains. They combine the advantages of automatic control with the known dependability of Ledeen Cylinders. Because of their rugged construction, these cylinders will deliver years of trouble-free service.

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Ledeen CYLINDER CAPACITIES

CAPACITY OF CYLINDERS FOR VARIOUS PRESSURES, LBS. PER SQUARE INCH

No. of Cylinder	50	60	75	90	100	125	150	200	250	300	400	500	600	750	1000	1250	1500	2000
1½"	40	50	60	100	117	151	195	260										
2"	150	160	189	216	240	298	480	640	810	1,080	1,320	1,650	2,020	2,700	4,050	5,400	6,150	
2½"	234	276	440	300	360	600	840	1,200	1,884	2,512	3,140	3,000	4,710	6,300	9,410	12,560	18,000	
3"	360	480	720	960	1,021	1,126	1,701	2,268	3,402	4,536	5,670	6,804	8,505	11,340	16,740	22,680	34,000	
4"	1,255	1,598	1,850	2,101	2,386	3,681	5,096	6,280	7,952	10,606	13,258	15,906	19,888	26,510	39,960	53,450	79,380	
5"	3,266	3,827	3,897	3,769	4,298	4,713	7,065	9,424	14,136	18,848	23,560	28,272	35,340	47,120	70,680	94,240	141,156	
10"	5,401	6,410	5,154	5,898	6,627	7,360	11,045	14,726	22,089	29,452	36,810	44,178	55,225	73,630	110,445	147,260	220,890	
12"	5,302	6,360	7,420	8,480	9,540	10,600	15,904	21,205	31,809	42,412	53,015	63,618	79,522	106,030	159,045	212,060	318,090	

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had been operating at capacity seven days weekly and treating about 30,000 tons of ore per month. J. C. Kieffer, Wallace, Idaho, is manager of ASARCO's Northwest mining department.

Western Placers at Puyallup, Washington has moved dredging equipment into Liberty, Swauk mining district, in the Cascade Mountains, to work gold and black sand deposits at the edge of town. E. A. Dickson is president and Earl Ewan is supervising the project.

A surface showing of radioactive limonite in southeastern Stevens County, Washington has been probed with diamond drill by *Laralarch Exploration and Development Company*. The firm also is carrying on exploratory work in the Mount Spokane district, Spokane County. Arthur W. Gural, Spokane driller, is president.

At the old *Peacock mine*, Conconcully, Okanogan County, Washington, *Alban Mining Company* of Northport is mining silver-lead ore and trucking it to a 50-ton mill at Omak. The property is leased from Yakima interests. Arthur Alban heads the firm.

A two-compartment shaft being sunk by *Sherman Mining Company* 1½ miles west of Omak, Okanogan County, Washington, was 50 feet deep at last report and development ore was being stockpiled for milling at Omak. Four men were employed. Cole Sherman heads the company.

John E. Meals, Seattle, has staked 13 mining claims in the Bossburg mining district of northern Stevens County, Washington.

Consolidated Mines and Smelting Company of Washington is making a public stock offering to finance construction of a flotation mill at its properties near Keller, Ferry County. A large tonnage of low-grade ore has been indicated by extensive exploration work. Values are chiefly in copper. Hugh Brown is president and manager.

The *Valley* gold mine, 10 miles northeast of Republic, Ferry County, Washington, has been acquired by *Thomas Consolidated Mines, Inc.*, of Spokane. Prior to its closure in World War II, the mine had yielded 354 railroad cars of ore which was shipped to the Tacoma smelter. Selenium has been identified in Valley mine ore by Washington State College researchers. David E. Watson is company president.

Mudhole Exploration, Inc. of Spokane, Washington, has started stripping operations to expose autunite found by trenching the Clarence A. Hanson property bordering the southern boundary of Mount Spokane State Park. Previous announced finds of the uranium ore have been in the western foothills of Mount Spokane. Adolf C. Nissen is president and Duane H. Watters, secretary-treasurer.

Clayloon Uranium Company has leased a six-claim prospect in Pend Oreille County, Washington's Metaline district from Clair MacArthur, Spokane, and is investigating surface showings of autunite and uranophane. Byrl Goodwin, Spokane, is president.

Bitco, Inc. has moved its headquarters from Wallace, Idaho, into a new $200,000 building in Spokane, Washington. The structure includes a machine shop and warehouse. The firm manufacturers drill rods and other mining equipment.

Charles A. Tilford is president and R. J. Stanford, Spokane manager.

Uranium exploration is under way on Sentinel Butte and Profanity Peak in the Republic area of Ferry County, Washington by *Dectronics, Inc.* of Roseburg, Oregon. Atomic Energy Commission geologists from Spokane, have been examining uranium prospects in the Republic area and new claim recordings have been made this season in the Sherman Creek, Curlew, Kettle River, Eureka, and St. Peter's Creek districts.

A. B. Davies of Odessa and Walter Bortz of Twisp, are in their fifth season of prospecting a copper property in Miners Basin, Chelan County, Washington. They have to pack in supplies 5½ miles. Diamond drilling of a wide mineralized zone is planned. Frank H. Mitchell, Spokane, is consulting engineer.

Kaiser Aluminum & Chemical Corporation's Trentwood rolling mill, Spokane County, Washington, has installed a $70,000 quantometer spectograph to improve quality control in production of aluminum alloy sheet and plate. Marvin L. Lee is works manager.

ARIZONA

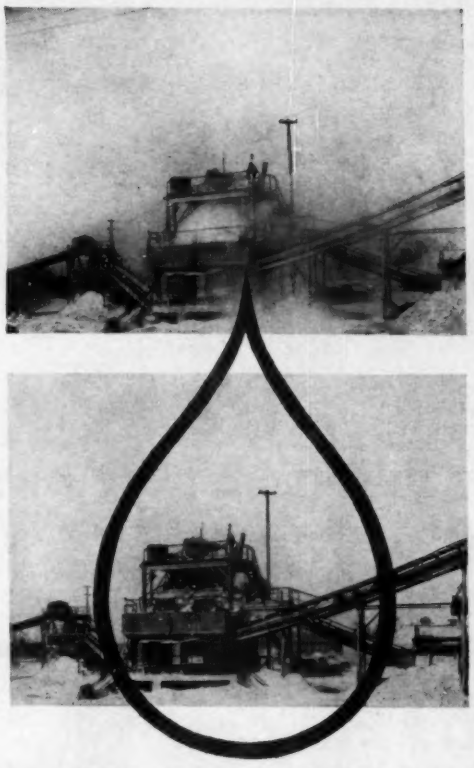
The *San Manuel* copper mine of *San Manuel Copper Corporation* in Arizona has now reached its scheduled full rate of output. This was achieved during the latter part of June. Hereafter, refined copper production is expected to be about 77,000 tons yearly. Production costs per pound of copper produced are expected to decrease materially.

Underground development work at the *Christmas* mine, near Winkelman, Arizona, is being resumed following replacement of the old and inadequate headframe and hoist on the development shaft. While this installation was in progress, underground work was largely suspended. Meanwhile, the existing small concentrator has been prepared for metallurgical test operations on ore derived from development work. The Christmas mine is being developed and prepared for production by *Inspiration Consolidated Copper Company*, Inspiration, Arizona. B. B. Whitney is general superintendent, and N. G. Thomson, mine superintendent.

Uranium-Petroleum Company is starting to drift on the *Rainbow* claims in the Marble Canyon area of Coconino County, Arizona. The company has been working on the property since last spring, and has stockpiled about 20 tons of ore averaging 0.22 to 0.25 U_3O_8.

The *Golconda Chemicals Corporation* of Kingman, Arizona, has taken a lease and bond on the old *Golconda* mine in the Mineral Park district. The 600-foot level drift is being reopened to connect with the Golconda shaft, last mined in 1917. Ore values are mainly in zinc. G. C. Patterson of Chloride, Arizona, is supervising the work.

The *General Development and Mining Company, Inc.* has started exploration work at the *Union* and *Tres de Mayo* mines with a crew of three men. Tentatively, the company is planning for installation of a 50-ton Wemco sink-float



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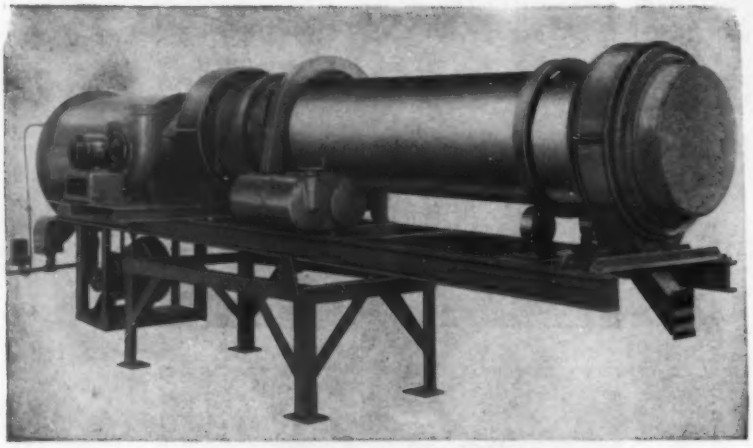

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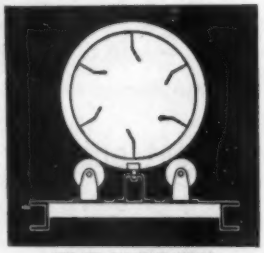
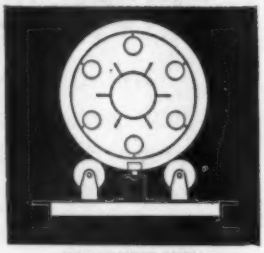
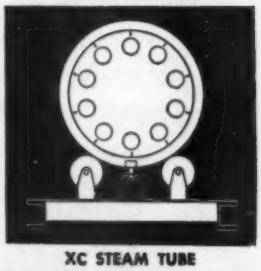
- Is easily moved from place to place.



XH-XF SINGLE-SHELL



XB DOUBLE-SHELL



XC STEAM TUBE

It is available in three models:

(1) XH-XF single-shell, direct gas fired dryer. Arranged for either parallel or counter-flow operation. Bulletin AH-471.

(2) XB double-shell, indirect-heat, gas-fired dryer for drying without contamination. Volatiles removed with only limited dilution. Bulletin AH-472.

(3) XC steam-tube indirect heat dryer. Can be connected to any available steam supply or furnished with a 3-HP steam generator. Bulletin

For complete information write Department 3

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mill to handle its own ores and also some custom ores. Herman D. Rhea of Nogales, Arizona, is president.

The *Cobre Grande Mining Company* of Safford, Arizona, has completed 10 miles of road to its property in the Aravaipa mining district, and is continuing exploration work on its open-pit copper property. About 200 tons of ore from development work have been stockpiled for shipment. Ten men are employed in the work under the direction of Ben Billingsley, superintendent, and Dan Hinton, foreman. Tom Beard, consulting geologist, is general manager in direct charge of the work.

The *San Xavier* lead and zinc mine, south of Tucson, Arizona, has been shut down since the first of July because of the radical drop in metal prices. According to W. D. Nelson, mine manager, prices went too low for the concern to continue profitable operations. The San Xavier mine and mill were purchased in February of this year from the *Eagle-Picher Company* by *McFarland-Hullinger Company* of Tooele, Utah. A crew of 35 men had been employed.

The *Coronado Copper and Zinc Company* at Dragoon, Arizona has closed its mines because of falling metal prices. When operated at peak capacity, the mine and mill had a payroll of about 1,000 men, but recently operations had been curtailed and the company had employed only 135 men. Fred E. Gray, mine manager, stated that the mine will be maintained on a stand-by basis with three men retained to keep the mine shafts unwatered. Coronado is a subsidiary of *Cyprus Mines Corporation* of Los Angeles.

Utco Uranium Corporation is drilling on 4,450 acres of ground near Cameron, Arizona under a permit issued by the Navajo Tribal Council. The permit surrounds the company's *Huskon No. 20* claim which produced a substantial amount of uranium ore in 1956 with an average grade of 0.40 U_3O_8.

The Tiajuana group of three claims in the Tyndall district of Santa Cruz County, Arizona has been acquired by *Mines Development Company* of Patagonia, Arizona. Principals in the company are Maurice Dalgleish and Orville J. Rigby of Patagonia. The purchasers have two portable diamond drills with which they propose to do some drilling across the vein in order to determine the average grade of ore. The holes, possibly 10 or 12, will be drilled to a depth of 100 to 150 feet. If initial work is favorable, a more extensive exploration program will be attempted. Ore values are primarily in copper with some lead, zinc, gold, and silver.

The U. S. Department of the Interior has approved placer mining operations for gold in the Richbar region of the lower Kern River Valley in California. Permission was granted to David H. Kenison, who holds title to the *Surprise* claims covering about 80 acres along the banks of the Kern River, provided he restores the surface of the claim to its original condition when mining has ceased, and that he posts a $10,000 bond

before starting operations. Mr. Kenison had been opposed by the *Pacific Gas & Electric Company* and the *Kern County Fish and Game Protective Association.* Further opposition is expected from PG&E when Mr. Kenison applies to the state water authority for water to operate the two placer mining machines.

Yuba Consolidated Gold Fields has three idle dredges for sale in California. These are the Callahan dredge in Siskiyou County, the Biggs No. 3 in Butte County, and the Yuba No. 15 at Hammonton, California.

Kaiser Steel Corporation is installing new facilities and equipment in its *Eagle Mountain* iron mine near Desert Center, Riverside County, California. These additions are expected to make it possible to increase iron ore production by 40 percent upon completion of the company's expansion program in 1958.

Surcease Mining Company has shut down its tungsten operations at Atolia, San Bernardino County, California. Recent production had been entirely under the block leasing system. This has now been terminated and cleanup work is being completed. The shutdown comes because of the Congressional refusal of appropriations to carry on the tungsten stockpile program.

NEVADA

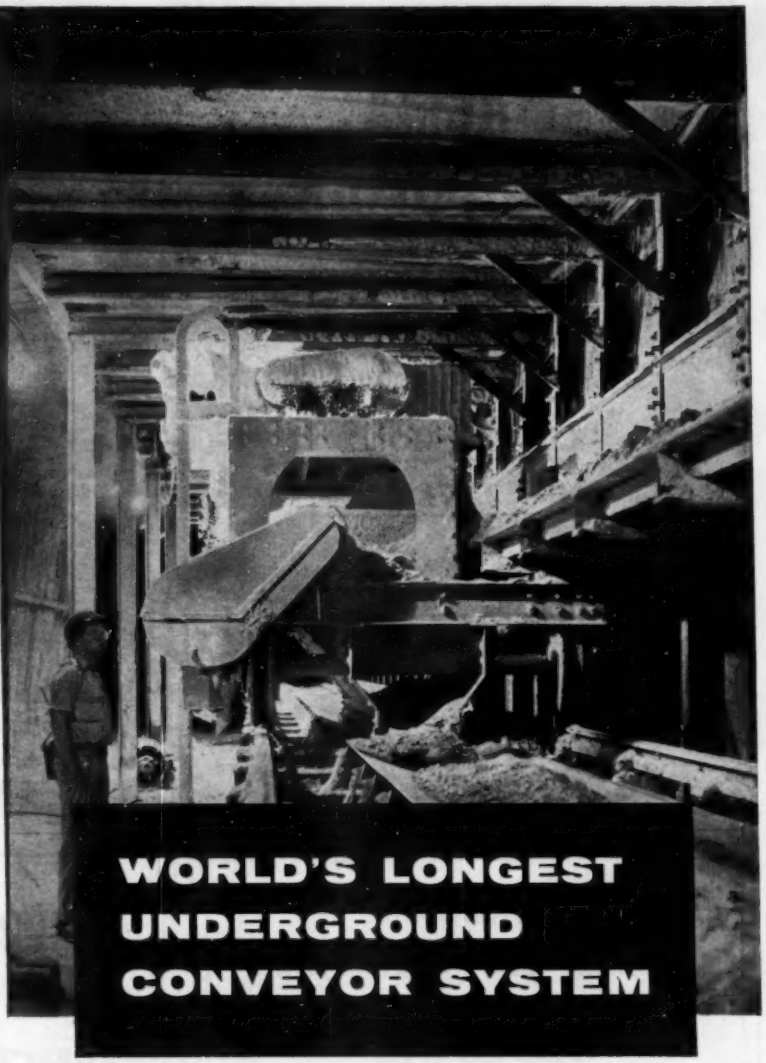
The *Nevada Mines Division* of *Kennecott Copper Corporation* has announced that its smelter at McGill, Nevada will operate on a six-day week only now instead of seven. Improved methods of metallurgy have made it possible to obtain approximately the same amount of blister copper in fewer operating days.

The *Continental Oil Company* has been exploring for uranium deposits in Elko County, Nevada. Drilling and exploratory work has centered around the property of Tom White and Enos Woodward of Mountain City and Edson Gregory and M. E. Ray of Elko. The oil company has an option with the owners to lease the property if there is any indication of a promising ore body.

The *Welchel Mines Company,* which now owns the old *National* mine north of Paradise Valley, Nevada, is reopening the tunnel and installing heavy equipment. The National was a rich gold and silver producer in its day. Wetchel now has an office in Reno. Main headquarters are at Caldwell, Idaho.

Copper Trio Mines Inc. is making shipments of copper ore from its property near Luning, Nevada to the leaching plant of *Kaysville Uranium Inc.* at Kaysville, Utah. A contract between the two firms calls for a minimum shipment of 100 tons a week and a maximum of 500 tons. Also in the contract is a provision for eventual erection of a leaching plant at Luning. The ore is coming from the company's *Champion mine.* The firm also holds a copper property in Dixie Valley which is said to be of higher grade ore, but transportation difficulties have not yet been solved.

Two States Uranium Corporation, which holds several properties in Wy-



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oming, is said to be developing mercury properties in Nevada. The properties are the *M&M* and *A&B* mercury mines about 47 miles northeast of Tonopah, Nevada. *Marc-Inc.*, a geological consulting firm, is said to be handling geological work on the properties, including assessment, drilling, and completion of road construction.

Consolidated Coppermines Corporation at Kimberly, Nevada, in keeping with its established practice of assisting students from White Pine County and other areas in obtaining a college education, furnished employment to 24 students this past summer. This represented about 7½ percent of the regular payroll. In addition to summer jobs, the company has given a scholarship each year for the past four years to a worthy student graduating from White Pine County High School.

The famous *Round Mountain* gold dredging and milling operation is being reopened, according to all reports. *Fresnillo Company* of Mexico is undertaking the Nevada project, with *Morrison-Knudsen* doing the stripping work. Actual dredging is not expected to start until 1958. The $3,000,000 plant was built by *Round Mountain Gold Dredging Corporation* in 1950, and closed in the fall of 1952.

The old *Belmont* lead-silver mine in the Hamilton district of White Pine County, Nevada has been purchased by the *East Standard Corporation* from Don Jennings.

NEW MEXICO

Vanadium Corporation of America has reported to *United Western Minerals Company* that preliminary drilling on its farmout on Sec. 36, T. 14 N., R 10 W., has been completed and sinking of a shaft has started. VCA will conduct all mining operations under the farmout and ore, which has a high vanadium content, will be shipped to the VCA mill at Durango, Colorado.

Ball Brothers Drilling Company is sinking a 300-foot, three-compartment shaft under contract for *Westvaco Minerals Development Company*. The property is about 20 miles northwest of Grants, New Mexico in Sec. 29, T. 13 N., R. 9 W., Valencia County.

Raines Construction Company of Grants, New Mexico has the $750,000 contract from *Kermac Nuclear Fuels Corporation* to erection surface installations and above ground equipment at the deep mine shaft in Sec 22, T. 14 N., R. 10 W.

Phillips Petroleum Company is drilling a new discovery in the southeastern part of Ambrosia Lake district, New Mexico. This is in Sec. 36, T. 14 N., T. 9 W. The company discontinued its program in the northeastern sector of the district (Sec. 36., T. 15 N., T. 10 W.) when no commercial mineralization was encountered.

Four Corners Exploration Company is completing its 25,000-foot drilling commitment on Sec. 14, T. 13 N, R. 9 W. under a farmout agreement with *United Western Minerals Company*. This ore

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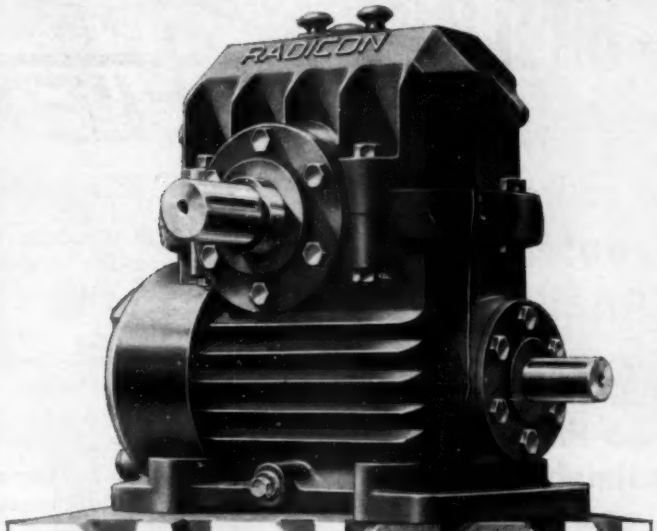

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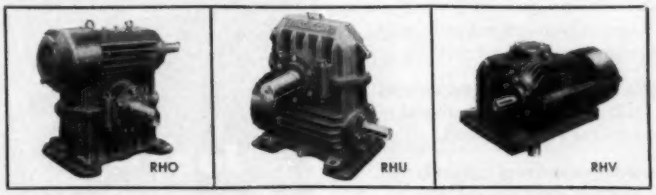

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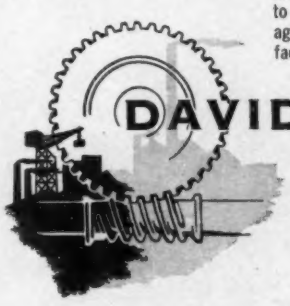

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body is in the Brushy Basin at shallow depths. Next phase is sinking of the mine shaft.

TEXAS

Anthony Lane, a British geologist, has leased the property of O. T. Patterson in the Deming Basin, south of Deming, New Mexico, after assays showed quantities of titanium, uranium, and hafnium. A placer operation is planned.

The *American Smelting and Refining Company* has opened a new assay and ore dressing laboratory for its Mexican Mining Department in El Paso, Texas. The $200,000 structure will handle an increasing amount of work from other operations; it does not indicate an expansion of ASARCO's Mexican operations. The old lab was 30 years old.

COLORADO

The *Trace Elements* uranium ore processing plant under construction at Maybell, Colorado, is nearing completion. *Southwestern Engineering Company* is the contractor for the plant which is a subsidiary of *Union Carbide Nuclear Corporation*. Located on a 20-acre site at about 6,300-foot elevation, the new facilities will include the first mill of its kind to use the continuous counter-current extraction operation in recovering uranium. The service building which will house the laboratory, maintenance shop, warehouse, and general offices, is already finished, and such other facilities as the crushing and sampling plant, mill building, special wood tanks, and reservoir are also ready. The new processing plant, the first to be established in Moffatt County, will be under the management of K. W. Lentz.

Cadwell Mining Company is reported to have completed arrangements for purchasing the processing mill of *Lincoln Milling Company* at Leadville, Colorado. Tests were first made to determine the recovery on lead, silver, and zinc from ore which Cadwell is mining from its *Hayden* mine on Fryer Hill east of Leadville. The 100-ton mill is to be leased by Cadwell to another firm for around-the-clock operation.

The *Dixie* gold-silver-lead mine on Ute Creek near Idaho Springs, Clear Creek County, Colorado has been sold by *LeRoy Giles and Company* to *Vicon, Inc.* with offices in Colorado Springs. The new firm plans extended development work.

The west end of Montrose and parts of Miguel counties, Colorado were the scene of a big uranium land rush in July when the *Bureau of Land Management* returned 100,000 acres to the public domain. The land is located in the rich Uravan mineral belt west and south of Nucla. *Union Carbide Nuclear Corporation* and *Vanadium Corporation of America* were well represented in the staking. One of the more colorful groups was that called *Greasy Sack Mining and Milling Com-*

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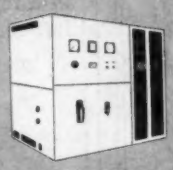

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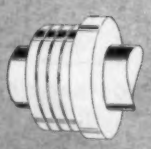

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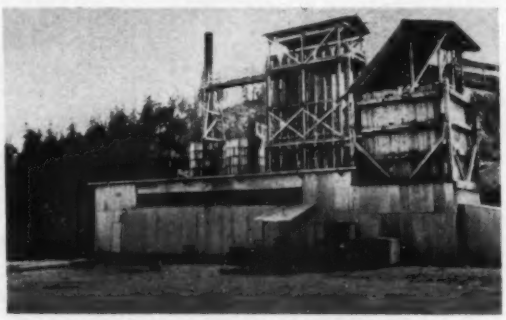

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pany which was made up of local people seeking claims in the area. Efforts now are on exploring and developing the property. Registration of the claims must follow within 60 days of staking and either an exploratory shaft or a survey map must be made before registration. Many overlapping claims will have to be settled in court.

The Sheriff of San Juan County, Colorado will sell at public auction on September 4, claims and equipment of *Shenandoah-Dives Mining Company*. The sale is to raise money to pay *American Smelting and Refining Company* which recently obtained a judgment against Shenandoah-Dives.

The declining lead and zinc prices have closed the *Resurrection Mining Company's* operations at Leadville, Colorado. The Resurrection has been mining under a joint working agreement with the *American Smelting and Refining Company*, where the two companies were partners for the working of their joint holdings through the Irene and Helena shafts. Development had just reached a point where full production could begin. Now the mill will be closed, and pumps pulled from the Helena shaft. Those in the Irene will continue for a while. Several months will be required to close the operations and mill the ore on hand.

A new tailing pond is being built by *Climax Molybdenum Company* near Climax, Colorado. This will be the fifth pond to be used by the firm. Pond Nos. 3 and 4 have been merged into one and it is adjacent to this one that the new pond will be built. The present pond should be able to handle production for another 15 years, but since it takes six to eight years to develop a new pond to the point where it would be capable of handling total tailings disposal, advance work must be started now. In addition to the new 40-foot toe dam to be built, a new tailing line will be installed.

SOUTH DAKOTA

Giant Resources, Inc. which acquired *Edgemont Mining and Uranium Company* earlier this year, has increased monthly output to 4,000 tons, according to T. R. H. Gillenwaters, president.

The *Old Mike* mica mine near Custer, South Dakota has been optioned to *Minnesota Mining & Manufacturing Company*. The option to purchase covers 25 mining claims, the crushing and screening plant, and auxiliary buildings and equipment.

UTAH

Lisbon Uranium Corporation, which went into production with its Ike shaft in March of this year, is now shipping between 3,000 and 3,500 tons of uranium ore monthly. Grade is said to run from 0.81 to 1.25 percent U_3O_8. A second shaft, the Columbia, has been completed for the firm by *Boyles Brothers Drilling Company*, and *Hidden Splendor Mining Company* is cutting stations. Hidden Splendor is a wholly owned subsidiary of *Atlas Corporation*, which also owns 74 percent of Lisbon. Hidden Splendor is handling mining operations on the Columbia claims, and ore production is expected to start this fall.

United Park City Mines Company is pushing ahead with development work on an ore zone located on the 1,900-foot level of the *Daly-West* sector of its property in the Park City district of Utah. Values are in lead, zinc, and silver.

The government has closed the AEC uranium ore-buying station and sampling plant operated at White Canyon, Utah. The opening of the *Texas-Zinc Minerals Corporation's* ore buying station at Mexican Hat, Utah in March, preparatory to completion of the mill now under construction, provides a market for ore produced in the White Canyon and Red Canyon areas. These ores will now be hauled to the Mexican Hat plant over a new direct road built by Texas-Zinc. Texas-Zinc was recently granted an 80 percent tax write-off on the $8,452,366 uranium plant.

Uranium Reduction Company, managed by *American Zinc, Lead and Smelting Company*, has been operating its new processing plant at Moab, Utah in excess

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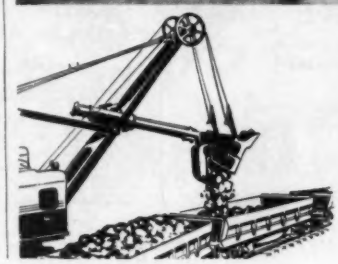

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of its maximum rated capacity of 1,500 tons per day. Negotiations are underway with the AEC to increase the company's contract to an average of 1,750 tons per day. The company was able to repay its $3,500,000 loan recently, in advance of the due date which was October 1958.

Cornucopia Gold Mines has started exploratory drilling of claims owned with *National Lead Company* in the Big Indian uranium district of San Juan County, Utah. Carl M. Stolle of Spokane is executive vice president in charge of western operations.

Diamond drilling has been resumed at the *Phoenix* claims in the northern sector of the Big Indian uranium district, San Juan County, Utah, by *Uranium Mines, Inc., Western Silver-Lead Corporation,* and *Square Deal Mining and Milling Company* of Wallace, Idaho. Drilling last year disclosed some ore at considerable depth.

Chief Consolidated Mining Company has closed its lead-zinc mine because of the low base metal prices. It was the last metal mine operating in the Eureka-Tintic district of Utah. The firm had closed its marginal mines five years ago.

WYOMING

Vitro Minerals Corporation now has 278 uranium claims in Wyoming. In addition to the 51 claims acquired from *Shoni Uranium Corporation* (see MINING WORLD, August 1957, page 79), the company recently purchased nine additional uranium claims and acquired options to lease 36 others in the same general area of Gas Hills. Of these 45 claims, Vitro purchased the *Myrna Lynn* uranium mine and surrounding properties, known jointly as the nine *Veca* claims, from Vern Hughes and Sam Stanbury of Riverton. Vitro also acquired one-year options to lease 21 claims of the *Hughes Mining Company* group and 15 claims of the so-called *H&S* group in East Gas Hills owned by Hughes and Stanbury.

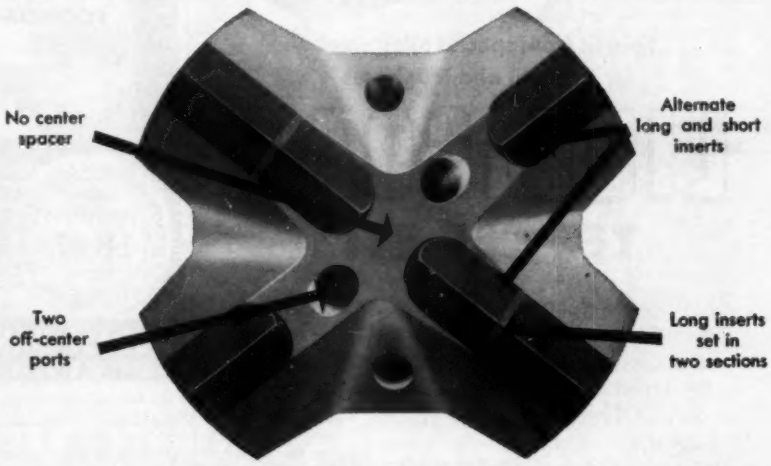
Phelps Dodge Corporation has joined with *Lucky Mc Uranium Corporation* in presenting a bid to the AEC for a 1,000-ton-per-day addition to the capacity of the Lucky Mc 750-ton mill now under construction in the Gas Hills district of Wyoming. This would provide increased space in the mill for custom shippers and would also accommodate production from the Phelps Dodge-*Wyoming Uranium Corporation* joint venture. According to Allen D. Christensen, president of Lucky Mc and Utah Construction, Phelps Dodge would receive a 30 percent interest in the 1,000-ton expansion but would not become a stockholder of Lucky Mc.

Davison Chemical Company Division of *W. R. Grace & Company* will build a $2,000,000 sulphuric acid plant at Casper, Wyoming to serve the uranium mining, oil processing, and other chemical activities in the Gas Hills area of Wyoming. The plant will have a capacity of 200 net tons a day, basis 100 percent acid. It is scheduled to go "on stream" in July 1958. Recovered sulphur from northeast Wyoming will be the raw material. In addition, spent alkylation acid and hydrogen sulphide from nearby petroleum refineries will be available for conversion to sulphur dioxide. These refineries, plus the uranium mills, will be the principal consumers of the acid.

The AEC has discontinued buying uranium ore at the Jeffrey City, Wyoming mill of *Western Nuclear Corporation.* Provisional purchases had been carried out there to provide a temporary market for ores from producers in the Crooks Gap and Gas Hills area. Now that the Western Nuclear mill has been completed, the latter will continue buying independent ores at about the same rate as during the provisional buying period.

Mt. Hi Uranium & Oil Company of Casper, Wyoming is exploring and developing uranium properties between Pine Ridge and Sussex in Johnson County, Wyoming. An estimated 374,000 tons of ore have been blocked out already, according to the firm, and three drifts are being driven into the ore body. A drilling program is also underway on the *Missy* claim in the same general area.

Trans-State Mining Company, a recently formed Wyoming corporation, has started operations on its copper deposit near Encampment, Wyoming, a formerly active copper mining area. Ore will be shipped to the *United States Smelting Refining & Mining Company's* plant at Midvale, Utah, and the copper to *American Smelting and Refining Company's* plant at Garfield. Robert F. Wilkinson is company president, Russell Twiford, Jr., of Douglas is vice president, and Guy Noel is secretary.



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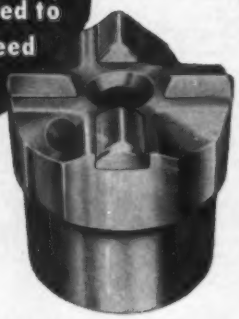

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New Company To Explore Canadian Iron Reserves

Cleveland-Cliffs Iron Company, through its wholly owned subsidiary, Canadian Cliffs, Ltd., has formed a corporate partnership with M. J. O'Brien Ltd., to explore indicated iron ore reserves at Lac Albanel, Quebec. Exploration by the new company, Albanel Minerals, Ltd., is reported to be a multimillion dollar project.

Both Cleveland-Cliffs and O'Brien have been working in the area for the past few years, and four drills are currently in operation. No estimates of tonnage or grade have been released as yet, but it is anticipated that several steel companies will take an interest in developing these iron reserves.

Cleveland-Cliffs holds the controlling interest in the new corporation.

New Company To Mine South African Gold Ore

A new company, Western Deep Levels Ltd., has been formed to develop the ultra-deep levels immediately south of the West Driefontein and Blyvooruitzicht mines in the Transvaal, Union of South Africa. A lease has been granted over about 6,864 claims adjacent to the southern boundaries of these two mines. The mineral rights are being ceded by the Blyvooruitzicht, Central Mining Finance Ltd., West Driefontein, West Witwatersrand, Western Ultra Deep Levels, and indirectly Witwatersrand Deep Ltd., which with Anglo American Corporation and New Consolidated Gold Fields are providing the initial capital.

Twin shaft systems are to be sunk immediately in the shallower eastern section of the lease area. Preliminary operations are already underway and consist of pre-cementation on the sites of the two systems. Initial development will be advanced on the upper Venterspost Contact Reef, and subsequently on the deeper, higher-grade Carbon Leader Reef. It is possible that a drive (probably of the twin type) will be advanced south from the West Driefontein No. 5 shaft into the new lease area to facilitate the initial opening up, especially for ventilation. The headframe will be of reinforced concrete. A reduction plant with an initial capacity of 100,000 tons monthly (later to be expanded to 200,000 tons monthly) is expected to be commissioned within six or seven years.

Joint Japanese-Brazilian Firm To Build Steel Mill

USIMINAS (Usinas Metalurgicas de Minas Gerais) is the steel plant which will be built by Japanese capitalists in the state of Minas Gerais, Brazil, as soon as the plans are approved by the Brazilian and Japanese governments. Initially, it will produce 500,000 tons of steel ingots; however, the production can be increased to 1,500,000 tons yearly.

The new plant will be located close to Acesita. The total investment will be 11,300,000,000.00 cruzeiros ($160,000,000). The capital will be 4 billion cruzeiros, 40 percent of which will be obtained from Japanese sources. The State of Minas Gerais will participate with a special economic tax; the steel plant of Volta Redonda, the principal plant in the country, is authorized to subscribe 120,000,000 cruzeiros; the Cia. Vale do Rio Doce will subscribe 350,000,000 cruzeiros, and the Banco Nacional do Desenvolvimento Economico will participate with 2,500,000,000 cruzeiros. Eighty percent of the equipment will be financed by the Japanese heavy industries.

During the first three and half years the plant will have two blast furnaces, with a capacity of 700 tons each. After this period, USIMINAS will be ready to produce 150,000 tons of wide metal sheets. In a second step, which will last two and half years, it will be built the laminators. One of them, to laminate thin sheets, will have 72 and 56 inches. The other, to laminate wide sheets, will have 120 inches or 3 meters.

CHINA—One of the largest tungsten deposits suitable for surface mining is reported to have been found in eastern Kwantung Province. According to the Geological Bureau of the Ministry for Metallurgical Industry, the veins of the deposit cover an area of about 10 square kilometers.

INDIA—During the first quarter of 1957, India produced 430,000 tons of manganese ore. This represented an increase over output of October-December 1956, but compared with the corresponding quarter of last year, production had dropped by 69,000 tons. It has been announced that three up-grading plants for improving the quality of low-grade manganese ore will shortly be set up within the country as a joint venture of public and private enterprise. The plants will cost about Rupees 30 lakhs to build, and will raise manganese content of the low-grade ore from its present 30 to 38 percent Mn to 46 to 48 percent Mn. One plant will be located at Belgaum, second in Vidarba, and the third in the Panchmahal mining area.

KOREA—A $598,000 exploration project is being undertaken by the Korean Office of Geological Survey with the assistance of the OEC. Primary object of the search is iron ore, but officials say they will not overlook any potential deposits. An intensive aerial survey with a magnetometer is part of the plan.

PAKISTAN—The Geological Survey of Pakistan has discovered a number of chromite deposits in the Ras Koh Range in Baluchistan, and some of these deposits are already being worked, according to reports. In Quetta division of West Pakistan, chromite has been mined for a number of years with about 30,000 tons being exported annually.

BURMA—The Burma government has now agreed to a valuation of £1,000,000 for *Mawchi Mines Ltd.'s* assets in Burma. This would be the basis for the capitalization of a proposed Burmese joint venture company to which Mawchi's assets would be transferred for shares, and in which the Burma government would then purchase an initial interest of 50 percent.

TURKEY — The Turkish government and an unidentified German firm (possibly *Krupp*) have signed an agreement for the construction of a new rolling mill at the *Karabuk Iron and Steel Works*. The mill, which will take about 20 months to construct, will bring total planned capacity of the Karabuk plants to about 700,000 tons.

MALAYA — *Southern Tronoh Tin Dredging Ltd.* has installed a small gravity and electrostatic treatment plant, and returns to date have been highly gratifying with recovery from the Amang dumps exceeding expectations. The future life of the No. 2 dredge depends entirely upon the successful extraction of values from clayey ground. Failure to do so would probably mean closing down of the dredge. The dredge entered this ground at the beginning of the current year and results to date show that the difficult ground is being profitably dealt with. No official decision has yet been announced on the company's application for leases over two rubber estates in the Sungkai district. The No. 1 dredge at Tronoh will probably be out of production for about three months while it is being converted from steam to electric drive. Appreciable economies are expected from this.

INDIA—The *Geological Survey of India* has traced a highly mineralized zone in the state of Bombay. The area, which is around Kolari in Umrer Tahsil of the Nagpur district, has been found to contain large deposits of chromite, copper, gold, antimony, and iron ores. Reportedly this is the first time copper and gold occurrences have been discovered here. Some of the deposits are said to be of commercial value. Detailed investigation of the region is to be followed by detailed geochemical prospecting. To bring out the complete picture of the entire belt, a geophysical survey has also been recommended.

MALAYA—*Tekka-Taiping Ltd.* expects to continue its output during this second half of 1957 on a satisfactory level. It is anticipated that by June of 1958, however, the present dredge run will come to an end and a new technical survey is being conducted, therefore. Future development work on the property will be decided in the light of what will be discovered in the course of this investigation.

JAPAN—According to the Mine Bureau of the Ministry of International Trade and Industry, mineral resources in Japan have been depleting as a result of increased production required by the domestic expanding economy. In view of the enlarging national economy, increasing demand for minerals, especially copper, lead, nickel, and manganese ores, should be covered by foreign ores which will be imported as a result of joint exploration ventures with producing countries in southeast Asia and Central and South America. Each of the major mining companies—for example, *Nippon Mining Company, Mitsui Mining & Smelting Company, Mitsubishi Metal Mining Company, Sumitomo Metal Mining Company, Dowa Mining Company*—have been carrying on a custom smelting contract or financial or technical assistance in return for ores. The Mining Bureau has recently analyzed the self-sufficiency of Japan concerning supplies of copper, lead, and iron ores in 1960: Domestic production of copper will rise from 78,200 metric tons in 1956 to 85,000 in 1960; imports will increase from 27,000 to 60,000; self-sufficiency will decline from 74 percent in 1956 to 59 percent in 1960. Production

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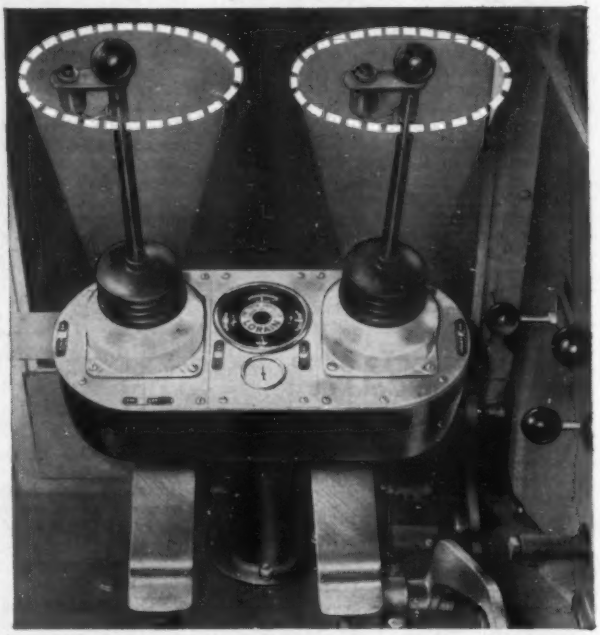

LEFT LEVER — Dotted circle indicates the "wobble stick" action. By positioning lever in various directions within this circle, operator can swing the turntable right or left, or raise the boom up or down. Intermediate positions within the circle combine any of these operations.

RIGHT LEVER — In the very same rotating action, the operator can control these operations: (1) Main Hoist; (2) Secondary Hoist; (3) Clamshell Holding; (4) Drag or Hoe Drag-in; (5) Shovel Crowd-Retract; (6) Third Drum; (7) Power Load Lowering.

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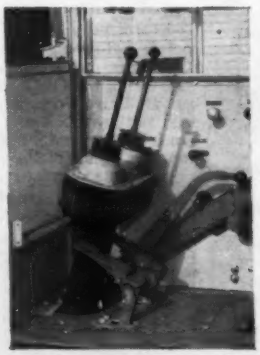

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of lead ore will increase from 29,800 metric tons in 1956 to 35,000 in 1960; imports will increase from 13,200 to 20,000; self-sufficiency will drop from 69 percent in 1956 to 64 percent in 1960. Iron ore production will increase from 1,810,000 metric tons in 1956 to 2,660,000 in 1960; imports will increase from 4,470,000 metric tons to 7,160,000; self-sufficiency will decline from 29 percent to 27 percent.

INDIA—All exports of iron ore and an increased share of manganese ore are being channeled through the *State Trading Corporation*. The award of a monopoly in iron ore export contracting will facilitate bulk movement. In this way, the government expects to export more than 2,000,000 tons of iron ore in 1957-1958 as compared with the 1956-1957 record of 1,760,000 tons. Japan is the principal buyer of iron ore, with Czechoslovakia and Poland next. Great Britain, the United States, The Netherlands, and Japan are the chief buyers of manganese ore.

BURMA—*Anglo-Burma Tin Company Ltd.* has been continuing tributing operations and preparatory work at the old company's former properties. This is essential before plant operations can be resumed. Capital requirements for working the mine by mechanized methods will be greater than the funds available, so consideration is being given to raising the needed funds.

ASIA—The Iron and Steel Subcommittee of the *United Nations Economic Commission for Asia and the Far East* has expressed satisfaction at the progress in building up and expanding the iron and steel industry in Asian countries. Reviewing Asia's iron and steel industry, 39 delegates from 15 countries attending the conference noted that Burma was completing its first steel mill capable of producing 40,000 tons of rolled steel annually; China (Taiwan) plans to establish a plant of 200,000 tons; on the mainland of China (according to press reports), the output of pig iron rose to 4,600,000 tons and of steel to 4,400,000 tons; India's steel industry is to be expanded to 6,000,000 ingot tons by about 1961; Japan's iron and steel industry is being greatly expanded to meet the vastly increasing demand which is expected to reach by 1960 about 19,000,000 tons of ingot steel, including 2,000,000 tons for export; the Republic of Korea plans to produce by 1966-70 some 400,000 tons of pig iron. The development of Asia's iron and steel industry should be assisted by a forthcoming study tour of Asian experts to Belgium, France, Federal Republic of Germany, Sweden, and the United Kingdom in October-November, organized jointly by ECAFE and the UN Technical Assistance Administration. A detailed study program, including techniques for small and medium-scale processes, particularly without using coking coal, was agreed on by the subcommittee.

MEXICO—A Canadian group has formed *Empresa Fluorite Mines Ltd.* to operate a fluorite mine in Mexico. Participating in the venture are *Empresa Minera de Nicaragua, Teck-Hughes Gold Mines Ltd., Waite Amulet Mines Ltd.*, and *Crowpat Minerals Ltd.* The property is reported to have been producing 200 tons per day for the past three years, and there are indications through diamond drilling that an increase in output can be put into effect as expanding markets warrant it. Another group of Canadian investors, represented by A. Aldasoro, is making investigations at a molybdenum property in the municipality of Tecate, state of Baja California. The mine is located 25 miles southwest of Mexicali. Ore is said to carry 5 percent molybdenum in the form of sulphide in a granite formation.

CUBA—*Standard Oil Company of Indiana* is seeking uranium on some of its oil concessions in Cuba. Specifically, the firm has filed for uranium rights on 25,000 acres of the more than 16,000,000 acres it has under concession in the country. Prospecting will be carried on by *Cuban Stanolind Oil Company*, a subsidiary. Associated with Cuban Stanolind which has a 50 percent interest in the project will be *Cuban Venezuelan Oil Voting Trust* and *Trans Cuba Oil Company*. The latter two will have a 25 percent interest.

BRITISH GUIANA—*British Guiana Consolidated Goldfields Ltd.* has completed its hydroelectric power plant at Tumatumari on the Potaro River. Electric power is now available for the Konawaruk dredge which should go into operation shortly.

MEXICO—*Compania Minera Nomar* which is operating at the *Las Fraguas* copper property 150 kilometers from Iguala, state of Guerrero, will improve the metallurgical process with the installation of flotation cells in order to obtain a better extraction. The mill will have a treatment capacity of 100 tons per day. The firm will continue to beneficiate the copper oxide ores with a sulphuric acid process to obtain copper cement.

CHILE—Production of nitrate in Chile last year has now been revealed as totaling 1,195,000 tons, the lowest figure during the last five years. The decline in output was due principally to the prolonged strike at the *Anglo Lautaro Nitrate Corporation's* plant, involving a loss of 290,000 tons. Belgium, The Netherlands, Denmark, and Sweden are reported to have renewed their agreements for the purchase of nitrate and will pay in convertible currencies. Negotiations with France for the renewal of the trade agreement are contemplated and it is hoped that the French government will grant permits for the import of a total of 120,000 tons of nitrate during the year ended June 30, 1958.

PERU—Ore reserves at *Southern Peru Copper Corporation's Toquepala* project are now estimated at over 1,000,000,000 tons. Estimates for each of the ore bodies are: Toquepala, over 400,000,000 tons; *Cuajone*, 500,000,000 tons; *Quellaveco*, 200,000,000 tons. The Toquepala is to be mined first by open pitting, with stripping overburden there expected to continue for another three years. The project is said to be the largest copper mining venture to be undertaken in a previously unmined and totally undeveloped area in more than a generation. By the time first copper is shipped in 1961, the investment will be around $200,000,000.

BRAZIL—A Brazilian firm interest in the metallurgy of tin, established in Volta Redonda, state of Rio de Janeiro, is said to have proposed to the Bolivian government an arrangement for treating low-grade ores from Bolivia in a smelting plant which would be built in the city of Santos, state of Sao Paulo, or elsewhere of mutual convenience. The Bolivian Ambassador is said to have already visited the tin smelter now operating in Volto Redonda.

MEXICO—Hidalgo mining companies will be among the chief beneficiaries of the highway being rushed to completion between Huetjutla and the city of Pachuca. Despite difficulties presented by the mountainous terrain, the 174-kilometer stretch from Pachuca to Ixtlahuaco has already been partially paved. The state government and the Federal Communications Ministry have allotted 1,740,000 pesos for the work to be carried out during the rest of this year. When completed, the road is expected to bring about development of mining locations it has not been possible to work before now because of the absence of transportation facilities.

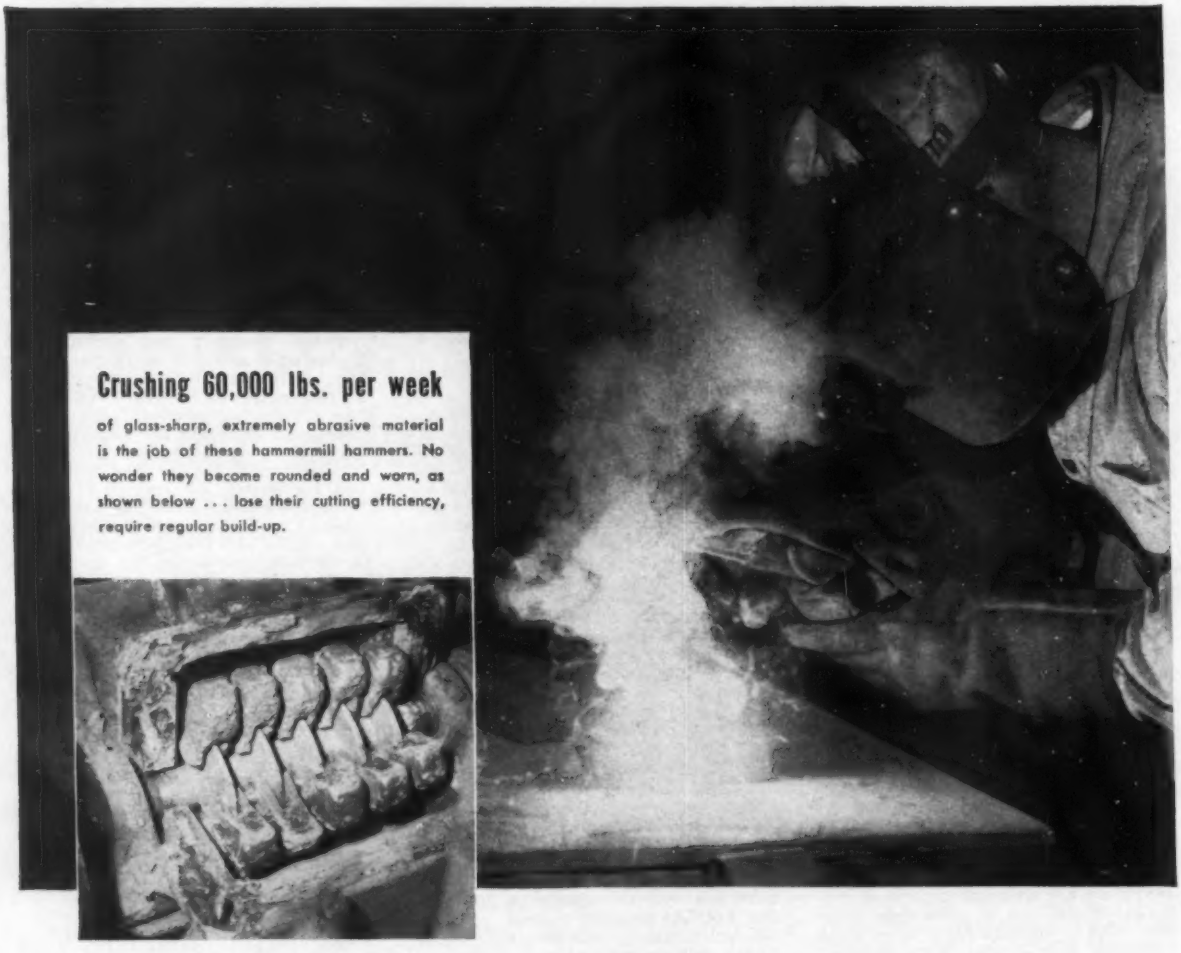
CUBA—A standard gauge railroad is under construction as a part of the mine expansion program being carried out in the Nicaro area. The *Cuban Nickel Company* is also designing and constructing a $1,000,000 process pilot plant at Nicaro under the supervision of the *General Services Administration*.

NORTHWEST TERRITORIES—Three United States groups are participating in a plan to explore the Arctic region for uranium, gold, iron, and oil. The *Cyrus S. Eaton* interests of Cleveland, together with *List Industries Corporation* of New York and *Scurry-Rainbow Oil Ltd.* of Calgary, Ontario and Cleveland, will finance an expedition to Baffin Island where the three-year search will start. A 112-foot ship, a former sub-chaser, has been converted for the job. It will carry a four-place Bell helicopter on deck.

ONTARIO—The *W. S. Moore Company of Minnesota* is drilling on the *Blairton* iron ore property near Marmora, which it has under option from *Frobisher Ltd.* Shipments were made from the property in the 1880's. Moore has two other properties in the same area, and an interest in a third. In the Mount Wright area of northern Quebec, the company is also drilling on property optioned from *Bellechasse Mining Corporation*. Some 100,000,000 tons of ore averaging about 30 percent iron were indicated in previous work done by Bellechasse.

BRITISH COLUMBIA — Exploration and development of surface exposures of high-grade lead-silver ore on the Adams Plateau near Squilax in southern British Columbia have been undertaken by *Sidney Mining Company* of Kellogg, Idaho, under an operating agreement with *East Lemhi Mining Company* of Spokane, Washington.

QUEBEC—A $5,500,000 expansion program is being undertaken by *Opemiska*



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Copper Mines at its property in the Chibougamau area. Deepening of the No. 1 Springer shaft has started, and the Perry shaft is being sunk to a 2,325-foot bottom at a rate of about 150 feet per month. A drift from the Springer No. 1 to the Perry will connect on the 975-foot level. Another phase of the two-year program is the sinking of the No. 2 Springer which has started. A fully automatic Koepe hoist has been ordered for this shaft. Capacity of the present 800-ton mill will be doubled.

ALASKA—The *Mount Andrew* mine, abandoned 50 years ago when copper ran out, is the site of exploratory drilling for iron ore. The operation is being carried out by the *Mount Andrew Mining Company*, a subsidiary of *Utah Construction Company*. Ralph Pray, territorial assayer, says that is may be several years before any mining of the property is initiated.

SASKATCHEWAN—Permits covering 200,000 acres of Crown lands in this province have been applied for by the *United States Borax and Chemical Corporation*. The firm did some drilling for potash there in 1956. Another 400,000 acres have been dropped.

NEW BRUNSWICK—*Nigadoo Mines Ltd.*, formed by *N. V. Billiton Maatschappij* to develop a lead-silver-copper-zinc deposit in a concession near Bathurst, is continuing shaft sinking and drifting in order to examine the deposit at various levels. The concession is actually near the village of Nigadoo, and lies near a railroad and secondary road. Billiton owns 60 percent of the new company.

MANITOBA—*Montgary explorations Ltd.* reports that significant cesium values have been discovered in the spodumene (lithium) ore body now being developed at Bernic Lake. More than 27,000 feet of cores obtained originally from diamond drilling to determine the nature and extent of the lithium ore are now being rechecked for cesium. More than 8,000,000 tons of spodumene ore averaging 1.85 percent Li_2O have already been proven by drilling. Sinking of a three-compartment shaft to the ore body is almost completed.

QUEBEC—A shaft sinking and underground program is underway by *Bateman Bay Mining Company* on its copper-gold property in the Chibougamau area. The decision to proceed came after a $600,000 exploration program which had sunk 180 diamond drill holes totaling 124,000 feet. The shaft will be collared on the "A" zone on Gouin Peninsula about 125 feet from the shore of Dore Lake. Three stations will be cut at 250, 375, and 500 feet, respectively. Depth of the shaft will be 530 feet. Engineers expect to intersect the ore zone at less than 100 feet from the shaft on the 500 level.

MANITOBA—*Partridge Canadian Explorations Ltd.* has completed the initial drilling program on its Eureka Island copper-nickel property in Herb Lake. The property is about 2½ miles south of the Rice Island property of *International Nickel Company of Canada* which is rumored to have about 2,000,000 tons 2.5 percent Cu-Ni. Partridge officials believe there is a similarity in the two properties, and they say it has been determined that concentration of relatively high-grade nickel-copper sulphide occurs in what may be termed the "keel" area of a pipe-like northeast plunging mass of gabbro or peridotite.

ALASKA—*Kendrick Bay Mining Company*, a subsidiary of *Climax Molybdenum Company*, has started mining by open pit and trucking the ore to the beach. Shipments will be made to the new uranium processing mill of *Dawn Mining Company* at Ford, Washington.

BRITISH COLUMBIA—In addition to its *Tulsequah* mine in northern British Columbia, *Consolidated Mining and Smelting Company* has also closed its *Sullivan* open-pit operation at Kimberley because of low lead-zinc prices. The company's zinc output is reduced by 20,000 tons a year and its lead production by a lesser amount as a result of these shutdowns.

ALASKA—The *Gold Placers Mining Company* is in operation on Coal Creek this season under the direction of Dale Patty. However, *Yukon Placers* ceased work at its Livengood property this season. Charles Herbert reported that his organization had sold most of its equipment. The ground was said to be good, but too large a proposition for the company to handle. Glenn Franklin and Harold Schmidt, formerly associated with Yukon Placers, are now mining in the Sixty-Mile area.

BRITISH COLUMBIA—Construction of a 50-ton mill at the *Utica* mine west of Kaslo in the Ainsworth mining division is planned by J. A. Cooper, lessee. Con-

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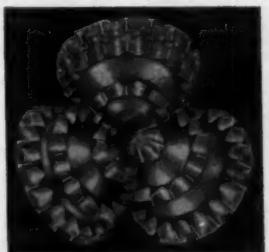

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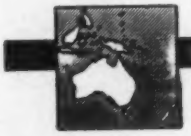
siderable crude ore has been shipped from the property. Exploration of several low-grade veins is underway.

ONTARIO—*Faraday Uranium Mines Ltd.*, which placed its new uranium mill in operation in April, is now milling more than 1,000 tons per day and expects to maintain this rate for the remainder of the year. In view of the increased mill capacity, negotiations have been entered into with *Greyhawk Uranium Mines Ltd.*, to treat Greyhawk ore on a custom basis in the Faraday mill. Under the agreement, Faraday is accepting 250 tons per day from Greyhawk from July 1, 1957 to October 1, and thereafter at a rate of 500 tons per day until completion of the contract Greyhawk has to supply uranium oxide to *Eldorado Mining and Refining Ltd.*

MANITOBA—*Silanco Mining & Refining Company* is mapping a program of exploration and development of its newly acquired properties in northern Manitoba. A 90-claim group in the Mystery-Moak-Thompson Lakes area (where *International Nickel Company* is establishing the world's second largest nickel mine) have been acquired by Silanco from the J. Ernest Ayrhart interests who have provided new capital to finance the development program. The latter will be under the management and direction of the Ayrhart organization. A contract has been let for a minimum of 2,500 feet of diamond drilling on a 25-claim group in the Wintering Lake area, five miles north of Thicket Portage on the Hudson Bay Railroad. An option held by Ayrhart on this property has been assigned to Silanco. *Falconbridge Nickel Mines Ltd.* did magnetometer and electromagnetic surveys in the area occupied by these claims from February to April of this year, and mapped out a number of magnetic anomalies. Previous surface exploration disclosed two mineralized schist zones of altered basic rocks striking west of north, containing disseminated pyrite, chalcopyrite, and pyrrhotite from which a trench sample assayed 2.20 percent copper and 1.33 percent nickel.

ALASKA—The *U.S. Smelting, Refining and Mining Company*, largest gold producer in Alaska, is now in full swing for the 1957 season. Eleven dredges are operating in three major areas—Fairbanks, Nome, and the Hogatza River region. The Hogatza operation is the newly opened site. Two years ago a dredge was moved overland from Livengood to the Hogatza region and for the past two years U.S. Smelting has done extensive road building and preparations for dredging. The operation is located about 60 miles west of Hughes and 70 miles north of Huslia. This puts a gold-bearing region into production that is practically untapped. Approximately 30 men will work the ground, most of them residents of the Koyukuk River region. Dredges are now at work at Cripple Creek, Gold Hill, Eengineers Creek, Dome Creek, Pedro Creek and Chatanika. At Sheep Creek dredging has started this season. The Ester dredge now operating at Gold Hill will be moved next winter to the Sheep Creek site. This old dredge has seen nearly 30 years of service with the company. Built at Goldstream in 1929 it worked at that spot until 1936 and then moved to Ester Creek. Ending that operation in 1948 it moved to its present location at Gold Hill. By ending its work this season it will reduce the Ester area mining operation to just that of the Cripple Creek dredge. Three dredges will be operating at Nome again this season. This is the first time since 1955 that all three have worked at one time. One dredge capsized in 1955 and parts salvaged and used in the erection of a new dredge last summer.



NORTHERN TERRITORY — *United Uranium N.L.*, *King Island Scheelite N.L.*, and *Loloma (Fiji) Gold Mines N.L.* will sink a shaft and carry out 500 feet of driving at 250 feet depth in the Maranboy tinfield. The work will concentrate on the *Osman* lease section of the main lode. Options over 12 mineral leases, totalling 136 acres on the *Main* and *Stannum King* lodes, have been secured, as well as two prospecting areas, covering 19 square miles, which include all known lode tin outcrops.

TASMANIA — The *Electrolytic Zinc Company of Australasia Ltd.* at Risdon again produced record zinc output in the year ended 30 June—106,622 tons compared with 104,964 tons in the previous year. West coast mines produced 191,238 tons of ore for 9,308 tons of lead con-

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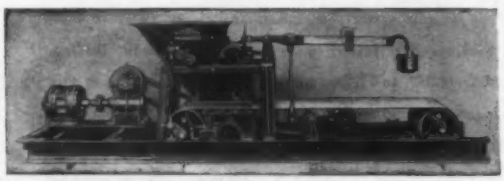

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	4' 6" & 6' 0"		10 Tons	Finely ground	No
14"	2' 6"	8 Tons		½" Cubes	No
	4' 6" & 6' 0"		20 Tons	½" Cubes	No
20"	2' 6"	15 Tons		1½" Cubes	No
	4' 6" & 6' 0"		45 Tons	1½" Cubes	Yes
30"	4' 6" & 6' 0"		125 Tons	3 " Cubes	Yes
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centrates and 56,279 tons of zinc concentrates; also 6,000 tons of copper concentrates.

QUEENSLAND — A uranium occurrence, of a type new to Australia, has been made near Westmoreland, in the State's north-west, on a prospecting area jointly held by *Mt. Isa Mines Ltd.* and *Zinc Corporation Ltd.* The type of formation—not stated—is found in Canada and elsewhere. Although apparently uneconomic, the deposit is largely covered and further work will be undertaken. The find is of interest as it will widen the possibilities for further uranium search in Australia.

SARAWAK—*Sematan Bauxite Ltd.* is to begin bauxite mining soon in the Sematan area of the Lundu district of Sarawak. A washing plant is being installed and an initial production of 500 tons daily is expected to start in April. The mining will be open pit using heavy equipment shipped from Singapore. The deposits were first discovered by Sarawak government geologists in 1949 and were later prospected by the *British Aluminium Company.* Proved ore is said to total about 2,500,000 tons, and there are reported to be other small deposits nearby.

NEW GUINEA—*Australian Gold Development N.L.* (Melbourne Prospecting Company) recently tested an area of 2,471 acres in the central highlands. Early results were very encouraging for discovery of good gold values but assay results from a number of samples range from a few dwts. to 18 dwts. per ton. Further work is being done but the tone of reports is now much less optimistic.

QUEENSLAND—Copper and lead production by *Mount Isa Mines Ltd.* set new records in the year ended June 30th. Ore mined was 1,297,000 tons, 677,101 tons of which were copper ore. Blister copper output was 26,335 tons; lead bullion totaled 40,875 tons. Zinc concentrate, 32,603 tons, increased by 1,919 tons, but total was still well below production of four years ago. The company has begun to install the largest electrical hoist in Australia, capable of raising 180,000 tons every four weeks. This is an increase of 80,000 tons over the present equipment. The new hoist, to be supplied by *British General Electric Company,* will be of 4,500 horsepower.

WESTERN AUSTRALIA — The new shaft of *Central Norseman Gold Corporation N.L.* at Norseman passed through the main Crown reef from 1,011 to 1,021 feet inclined depth. The reef assayed 6.1 dwts. over a true width of 30 inches. Crown shaft is 1,000 feet west of Regent shaft. Values of 37.2 dwts. over 69 inches width have recently been exposed in the company's *Princess Royal* mine.

NORTHERN TERRITORY — *United Uranium N.L.* has made its third pitchblende shipment to the United States. Deep drilling on Saddle Ridge lode gave favorable indications of a repetition of the ore body at the junction of the main fault and unconformity at 300 feet depth. The deepest hole cut 25 feet of lode assaying 0.20 percent U_3O_8 at 200 feet. Waggon drilling is now under way on the *Coronation Hill* area while pitchblende mining has begun on the *Palette lode.*

NEW ZEALAND—Among foreign mining companies interested in claim over 36,000 acres of land in the Buller area on South Island is reported to be *Rio Tinto Ltd.*

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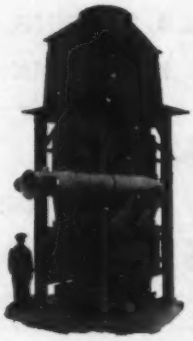

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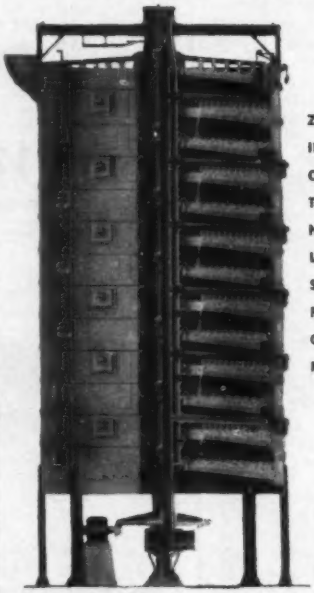

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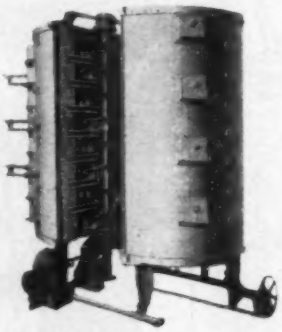

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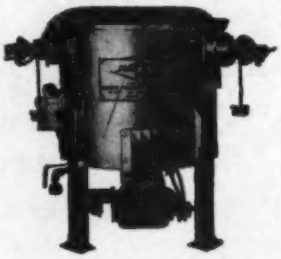

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TASMANIA—Iron ore deposits near the Savage River on the west coast between Waratan and Corinna may be considerably larger than previously believed. The area is held by *Rio Australia Pty. Ltd.* A scintillometer survey gave good recordings; geological and geophysical work will be followed by diamond drilling. If reserves of sufficient grade and quantity are proved, the Tasmanian government will press for the erection of steel plants in Tasmania.

REPUBLIC OF THE PHILIPPINES—*Benguet Ventures Inc.* is developing a disseminated copper ore deposit in Boneng, Atok, and another section of 380 hectares in a part of Baguio City between Camp John Hay and the property of *Atok-Big Wedge Mining Company.* It is hoped that the Baguio property contains the extension of the copper-gold veins found in the Atok-Big Wedge property and the *Kelly* group. The Kelly will be developed by Benguet Consolidated through a long crosscut now being driven with its portal near Virac.

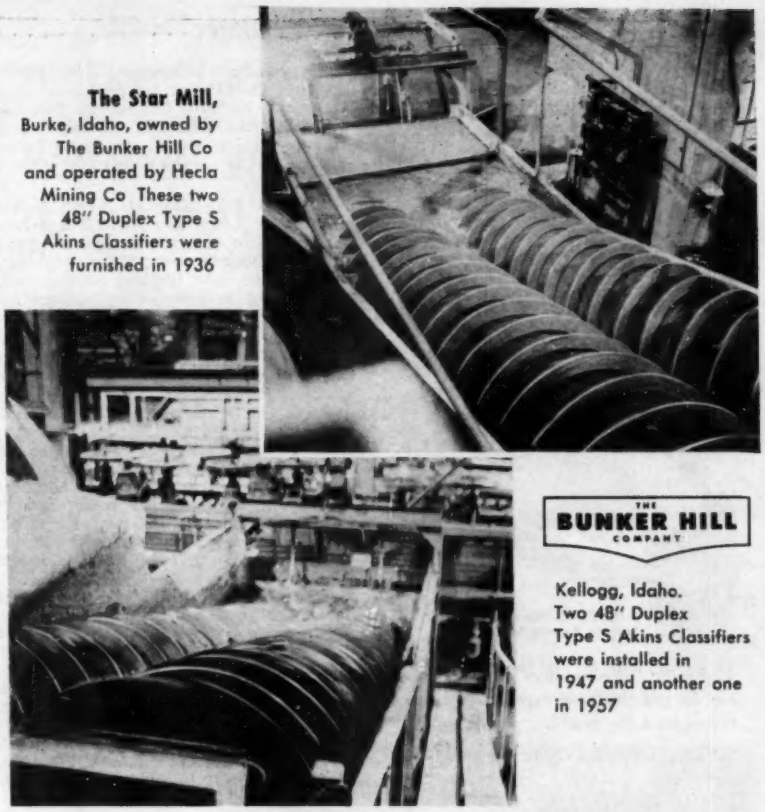
AFRICA

SOUTH WEST AFRICA—*Consolidated Diamond Mines of S.W. Africa Ltd.* will apply to the High Court of South West Africa on November 4, 1957, for a declaration of rights resulting from the Administration's granting of a concession to *South West African Prospectors.* In January of this year, the Administration granted a concession along the 170-mile stretch of coast between Oranjemund, where the Consolidated Diamond Mines plant lies, and Diaz Point, covering an area from the high water mark to a point 800 yards into the Atlantic Ocean. This promises to be a big legal battle. C.D.M., which last year exported more than £17,500,000 worth of diamonds from the coastal area, states that its rights extend "to the Atlantic Ocean," and have always been interpreted as the "low water mark."

FEDERATION OF RHODESIA & NYASALAND—Steady progress continues at the *Ndola Copper Refineries Ltd.*, a subsidiary of *Roan Antelope Copper Mines*, and it is anticipated that the first section of the copper refinery will be ready for operation by March of 1958. Excavations and foundations for doubling of capacity are concurrently in progress.

UNION OF SOUTH AFRICA—With completion of the reinforced concrete headframe, *Riebeeck Gold Mining Company Ltd.* is now preparing to sink the shaft. A twin-haulage has been completed from the *Loraine* mine to the northern Reibeeck section. The mining agreement under which Reibeeck is operating confines its initial activities to the Kimberley-Elsburg reefs which lie above the Leader Reef. The major portion of the mine's tonnage will be from the shallower Elsburg Reefs, which are multi-banded over a strike length of 25,000 feet and over a lateral width indicated by drilling as about 1,300 feet at its greatest.

FEDERATION OF RHODESIA & NYASALAND—*Bikita Minerals (Private) Ltd.'s* new picking plant is in operation at the *Bikita* lithium deposit near Fort Vic-



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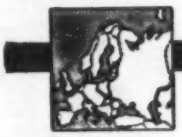
INTERNATIONAL

toria, Southern Rhodesia. The project supplies the lithium ore requirements of *American Lithium Chemicals, Inc.* and of glass manufacturers and other users throughout the world. *American Potash and Chemical Corporation* owns stock in both firms.

UNION OF SOUTH AFRICA—The *Afrikander Lease Ltd.*, which has been treating ore from its higher grade Rhenosterhoek Section, is now sinking a shaft in the new Rietkuil Section, with initial progress retarded by surface and sub-surface weathered granite.

UGANDA—*Kilembe Mines Ltd.* reports that a recovery of 91 percent of the copper contained in the ore is being obtained while treating ore grading 2.25 percent Cu. Milling was started in June of last year, and smelting facilities went into operation late in the year. Some difficulties have been encountered in the smelting circuit, so that it has not been possible to maintain full rated capacity of 750 long tons of blister copper monthly. The rated capacity of the concentrator, 40,000 tons per month, was reached in November and this rate has continued.

UNION OF SOUTH AFRICA—*St. Helena Gold Mines Ltd.* expects to complete sinking its No. 2 shaft in the northeastern section before the end of this year. However, the area is not expected to contribute any worthwhile tonnages of ore to the mill feed before 1959. By that time, it is planned to raise the reduction plant capacity an additional 25,000 tons to 150,000 long tons monthly. Capital expenditures will slightly exceed £1,000,000 this year.



WEST GERMANY—Discovery of uranium ore in commercial quantities is reported in the Baden-Wuerttemberg area in the southwest part of the country. Scientists of the Geological Institute of the Baden-Wuerttemberg state made the discovery of 11 deposits while exploring the Black Forest region.

BELGIUM—Belgian, Dutch, and Belgian Congo zinc producers have founded an association for the promotion of the use of zinc. To be called the *Centre Belgo-Hollandais d'Etudes et de Recherches pour le Development des Usages du Zinc* (for short, *Centre d'Etudes du Zinc*), the group will have offices at 21, Rue du Marain in Brussels, and 18, Stationsweg, The Hague.

NORWAY—A promising deposit of Oriental ruby, a variety of corundum, has been discovered at Froland in southern Norway. Though not perfect, the rubies reportedly have a fine sheen.

EIRE—*Can-Erin Mines Ltd.*, reports that, in addition to the progress being made at the company's *Allihies* property, the firm has purchased control of *Minerals Development* and its operations covering a 1,500-square-mile concession in Counties Galway and Mayo. Work on the property to date has uncovered an interesting molybdenum deposit and a periodite belt. At *Castleblayney*, a gold deposit of commercial grade is being developed, while at *Beauparc* work has been suspended because results did not warrant further expenditure at this time. A complete mining plant has been set up

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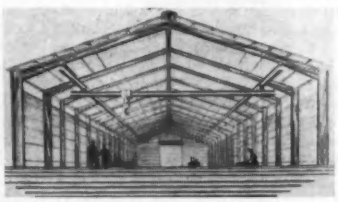

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at the Allihies property, mentioned above, where the underground mining will be under the direction of a Can-Erin subsidiary, *Emerald Isle Mining Company*.

SCOTLAND—*Lowland Lead Mines*, a subsidiary of *Siamese Tin Syndicate Ltd.*, has started trial milling in the main section of its new mill, by treating rock dump material and development ore, as well as mine ore. The percentage of recovery is encouraging and already an excellent concentrate reportedly is being produced. No attempts are presently being made to produce a saleable concentrate, but zinc-bearing material is being stockpiled for further treatment, probably at a time when the price of zinc is higher. Ore reserves at the end of 1956 showed indicated ore totalling 102,000 tons, and inferred ore totalling 83,000 tons. This is in addition to surface dump material and old fill, amounting to 154,000 and 108,000 tons, respectively.

WEST GERMANY—Iron ore exploration in the northwestern part of the country is said to have led to the discovery of extensive deposits near Wittmund. A large layer 40 to 47 feet thick is reported to have been found at a depth of 6,000 feet; ferrous content of the ore was around 40 percent. The deposits probably will not be developed for sometime because of technical difficulties.

ITALY—During the first quarter of 1957, 16,126 flasks of quicksilver were exported from Italy. Of these, 4,051 flasks were shipped to Brazil, 3,550 to the United States, 2,680 to Japan, 1,699 to West Germany, and the remainder to the United Kingdom, Austria, and India.

ITALY—At the *Montevecchio* mine in Sardinia where a large lead-bearing vein is being developed (see MINING WORLD, July 1955, pages 54-57), new methods were recently introduced for the mechanization of the cut-and-fill stopes. In addition to the self-propelled cars for spreading the fill (already described in Professor Parkinson's article in MINING WORLD, March 1957, pages 50-53), a new self-loading, self-discharging car has been designed for underground operations. Designed by Montevecchio's engineers, the car has a built-in power shovel which loads the ore for transporting and dumping into ore passes. The car is air-operated, self-propelled, and rubber-tired-mounted; it recently became a current model of *Atlas Copco* of Stockholm. On a long period of experimental service, the car loaded about 55 cubic yards of ore per hour and transported it on an average distance of 70 feet.

EIRE—*Priority Drilling Ltd.* which has been conducting prospecting surveys for copper and other minerals in the Fintown area of County Donegal, is to begin test boring near Glenties. Old copper, lead, and zinc workings exist in this area, but most of them ceased producing more than 100 years ago.

YUGOSLAVIA—Productivity is expected to increase this year. Output of iron ore should reach 1,800,000 tons, and steel 1,000,000 tons. Output of iron ore increased 21 percent in 1956, and pig iron 23 percent. Of prevailing importance in the successful expansion of the steel industry has been the Niksic (Montenegro) iron works, destined to be one of the largest in Yugoslavia, and the completion of the Zenica iron works, the largest existing plant in the country. Because of large investments made in the steel industry, iron ore production was some 25 percent greater than that of 1939.

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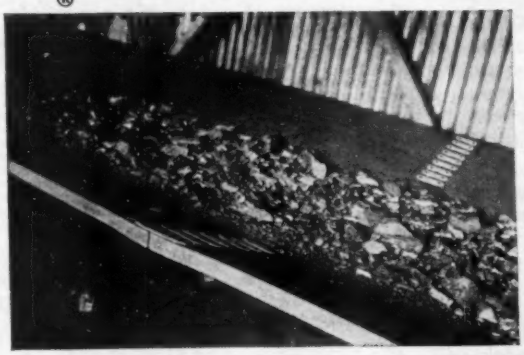

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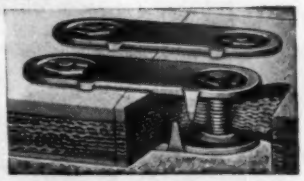

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COLUMBIUM:	**Powder** Nom., per pound	$120.00
GERMANIUM:	**Germanium:** dioxide, high purity, gram	24.00¢-30.00¢
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URANIUM:	**Nominal,** per kilogram	$40.00
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GOLD:	**United States Treasury Price**	$35.00 per ounce
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CHROME ORE:	F.o.b. railroad cars eastern seaports. Long tons dry weight.	
	African (Rhodesian). 48% Cr_2O_3. 3 to 1 Ratio	$55.00-$56.00
	African (Transvaal). 48% Cr_2O_3. No Ratio	$38.00-$39.00
	Turkish, 48% Cr_2O_3. 3 to 1 chrome-iron ratio	$59.00
	U. S. Government ore purchase depot Grants Pass, Oregon, Base price, lumpy ore, $115.00; fines and concentrates $110.00 for 48% Cr_2O_3 and a 3 to 1 chromium-iron ratio. Premiums for higher grade are and for a ratio up to 3.5 to 1. Penalties for grades down to 42% Cr_2O_3.	
COLUMBIUM-TANTALUM ORE:	At United States small lot beryl purchase depots. $3.40 per pound contained combined pentoxides in 50% ore. Includes 100% bonus. (Government stopped buying temporarily May 12)	
	Per Pound Pentoxide.	$1.15-1.35
IRON ORE:	**Lake Superior. Per gross ton Lower Lake Ports**	
	Mesabi, Non Bessemer, 51.5% Fe.	$11.45
	Mesabi, Bessemer, 51.5% Fe.	$11.60
	Old Range Non Bessemer.	$11.70
	Old Range Bessemer.	$11.85
	Swedish, Atlantic Ports, 60 to 68% Fe Contracts, Per Unit	25.00¢
MANGANESE ORE	**Metallurgical grade.** 48 to 50% Mn. Long ton unit	$1.40-$1.45
	Metallurgical grade. 46 to 48% Mn. Long ton unit	$1.35-$1.40
	Metallurgical grade. 44 to 46% Mn. Long ton unit	$1.30-$1.35
	Domestic U. S. Government ore purchasing depots: Butte, Montana; (black and pink ores) base price of $4.87 per long dry ton of 18% manganese ore. Phillipsburg, Montana; base price of $6.43 per long ton of 15% manganese ore. Small lot program f.o.b. railroad cars, minimum 40% Mn. Base price (48%) $2.30 per unit with premiums and penalties.	
MOLYBDENUM CONCENTRATE	**90% MoS_2 F.o.b.** Climax, Colorado. Per pounds of contained molybdenum, plus cost of containers	$1.18
TUNGSTEN CONCENTRATE	**Domestic.** 60% WO_3 Per short ton unit Government not buying	$55.00
	Foreign. 65% WO_3 Per short ton unit (Scheelite)	$16.00
	Foreign. South American, Spanish, Portuguese	$15.00-$16.00
URANIUM ORE:	**Carnotite-Roscoelite.** F.o.b. purchase depot or company mill plus $0.06 per ton mile ($6.00 maximum), Grand Junction, Rifle, Durango, Naturita and Uravan, Colorado. Salt Lake City, Marysvale, Thompsons, Moab, Green River, Mexican Hat, and Monticello, Utah. Shiprock, and Grants, New Mexico, Edgemont, S. Dakota, Jeffrey City, Wyoming, Tuba City, Arizona. Base price for 0.10% ore is $1.50 per pound and up to $3.50 per pound of contained U_3O_8 plus $0.75 per pound for each pound in excess of 4 pounds per short dry ton and an extra allowance of $0.25 per pound for each in excess of 10 pounds. A $0.50 per pound development allowance paid on all ore purchases. Special lime schedule applies at Monticello, Moab and Grants. No lime penalty with no vanadium payment or lime penalty with vanadium payment.	
VANADIUM ORE:	**Carnotite-Roscoelite.** V_2O_5 in ratio of more than 10 parts to 1 part of U_3O_8 are generally acceptable at all AEC depots, but excess not paid for at Marysvale, Monticello, and Bluewater. Shiprock has no limit on V_2O_5 to U_3O_8 ratio and all contained V_2O_5 is paid for Per Pound V_2O_5	$0.31

NON-METALLIC MINERALS

BENTONITE:	**Minus-200-mesh.** F.o.b. Wyoming points. Per ton in carload lots	$12.50
	Oil Well grade. Packed in 100 pound paper bags	$14.00
FLUORSPAR:	**Metallurgical grade.** 70% efective CaF_2 content per short ton F.o.b. Illinois-Kentucky mines	$40.00
	Mexican. 70% F.o.b. border	$24.00-$24.50
	Acid Grade. 97% CaF_2, Bulk, F.o.b. Kentucky, Illinois, Colorado	$50.00
	Government buying F.o.b. producer's shipping point: 60% Illinois-Kentucky, $34.50 per ton, others $28.50; 70% Ill.-Ken. $38.50, others $32.50.	
PERLITE:	**Crude:** F.o.b. mine per short ton	$3.00 to $5.00
	Plaster grades. Crushed and sized. F.o.b. plants	$7.00 to $9.00
SULPHUR:	Long ton, F.o.b. Haskins Mound, Texas	$25.50
	Export	$30.50

LONDON METAL AND MINERAL PRICES

			August 12, 1957	Per Long Ton USA Equivalent cents per pound[1]
COPPER:	**Electrolytic spot**	£208	0s 0d	26.06¢
LEAD:	**Refined 99%**	£ 91	5s 0d	11.41¢
ZINC:	**Virgin, 98%**	£ 73	10s 0d	9.19¢
ALUMINUM:	**Ingot, 99.5%**	£197	0s 0d	24.625¢
ANTIMONY:	**Regulus, 99.6%**	£222	10s 0d	27.81¢
TIN:	**Standard, 99.75%**	£738	0s 0d	92.25¢
TUNGSTEN:	**Long ton unit**	1125		$15.68

[1] With Sterling pound at $2.80.

Quotations on metals and certain ores through the courtesy of *American Metal Market, New York, N. Y.*

Personalities

Continued from page 73

liams was selected to replace **Frank Maloit** on the group. Mr. Burwell is president of Minerals Engineering Company and Mr. Viles is vice president and general manager of Vanadium Corporation of America.

Chelsea Phillips, sales engineer representative for Hewitt-Robins, was elected chairman of the Minerals Benefication Sub-section of the Minnesota A. I. M. E. Other newly elected officers include **Leon D. Keller**, Dorr-Oliver Company sales engineer, as vice president, and **Fred Bunge**, research supervisor for M. H. Hanna Company, as secretary-treasurer.

Adolph V. Mitterer was promoted from plant geologist to mine engineer with International Minerals & Chemical Corporation. Mr. Mitterer replaces Robert H. Lane who is being transferred to Canada.

Marion Bolton is the new manager of Kerr-McGee Oil Industries mining and milling operations at Shiprock, New Mexico. **George Cobb** was promoted to director of the uranium division and **V. L. Mattson** will take charge of uranium research activities in Denver. **Dick Zitting** will direct uranium explorations from Kerr-McGee's Oklahoma City headquarters.

Jerry E. Tong, former assistant resident manager of Duval Sulphur & Potash Company's Potash Division at Carlsbad, New Mexico, will succeed **George Atwood** as resident manager. Mr. Atwood has been transferred to the newly established Copper Division near Tucson, Arizona. **H. A. London** superintendent of maintenance and construction, **I. B. Phillips**, mill superintendent, and **B. G. Messer**, former chief engineer, were also transferred to the Copper Division from Carlsbad. They will retain their former positions with the exception of Mr. Messer, who will be assistant resident manager.

W. B. Dancy has accepted the position of superintendent of Development and Control with the International Minerals and Chemical Corporation. He is replacing **Howard P. Clark** who has resigned to accept another position. Mr. Dancy has been with the corporation for 12 years.

Kenneth Duncan, who retired in 1954 as manager of mines for Pickands Mather & Co. in the Lake Superior District, received the Duluth Hall of Fame award, sponsored by the David Wisted Post of the American Legion. Earlier this year Mr. Duncan received the Outstanding Citizenship Award of the Duluth Community Chest.

James Shore has joined the metallurgical laboratory of Climax Molybdenum Company at Climax, Colorado. He was formerly with Miami Copper Company in Arizona. **Herbert Kay** has joined the process engineering department at Climax, where he will be concerned with the development of new processes and the design of process equipment.

The University of Utah College of Mines awarded professional degrees to two alumni at the commencement ceremonies in June. The degrees were received by **Ray E. Marsell**, professor of geology at the university, and C. L. Thornburg, mines geologist for United States Smelting, Refining and Mining Company.

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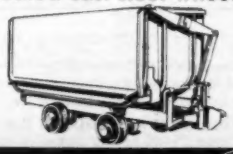

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Obituaries

Conrad F. Nagel, 65, retired vice-president of the Aluminum Company of America, died recently at his home in Pittsburgh, Pennsylvania. Having served with Alcoa since 1915, Mr. Nagel is credited with development of a process to produce feather aluminum used in explosives, and also helped to establish aluminum as a major material for aircraft. He was a member of the American Institute of Mining and Metallurgical Engineers.

Walter R. Anyon, 60, secretary of the New Jersey Zinc Company died recently in Greenwich, Connecticut. Mr. Anyon began his employment with the company in 1915, and was appointed secretary in 1948.

Roger Williams Straus, retired chairman of the board of American Smelting and Refining Company, died recently at the age of 65. Mr. Straus joined American Smelting in 1914, was made director in 1916, and in 1941 was elected president. He retained that position until 1947, when he became chairman of the board. At the time of his death, he was director of the company and also of Revere Copper and Brass, Inc., General Cable Corporation, New York Life Insurance Company and New York Telephone Company.

Conrad F. Trowbridge, 54, died in Duluth, Minnesota, recently. Mr. Trowbridge had been assistant general manager in charge of railroad and harbor development for Erie Mining Company, a Pickands, Mather & Co. enterprise, since 1951. He was assistant vice president for the Pennsylvania Railroad before joining P.M.

Henry Newton Wolcott, 63, geologist with the United State Geological Survey at Phoenix, Arizona, died recently. Following World War I, Mr. Wolcott worked for several years for Phelps Dodge Corporation, then operated his own mine and leased in the Tombstone and Courtland areas. Several years prior to joining the Geological Survey, he was employed as a field engineer, Arizona Department of Mineral Resources.

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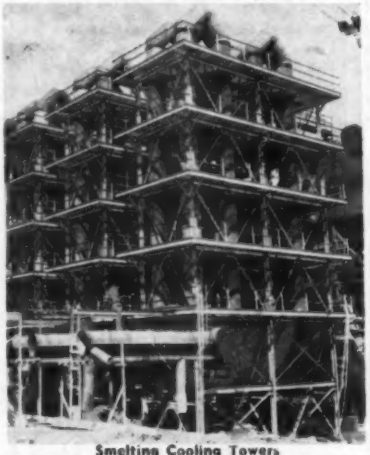

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INDEX OF ADVERTISERS IN MINING WORLD

• *Asterisk indicates firms whose products are catalogued in* MINING WORLD's *1957 Catalog, Survey & Directory Number.*

Agence Miniere & Maritime, S.A. 124
Allis-Chalmers Mfg. Co., Const. Machy. Div. 29, 30, 31
★Allis-Chalmers Mfg. Co., Industries Group, Export Div. ..... WM12 (World Mining Only)
Allison Steel Mfg. Co. 131
★Alloy Steel & Metals Co. .. 124
★American Brake Shoe Co., Export Div. ..... WM52 (World Mining Only)
★American Cyanamid Co. .. 10
★American M. A. R. C., Inc. 122
★American Manganese Steel Div. 43, 118
American Potash & Chemical Corp. 37
★American Smelting & Refining Co. 112
★American Zinc Sales Co. .. 106
★Anaconda Co. 18
Arizona Testing Laboratories 128
Athey Products Corp. 20
Atlas Car & Mfg. Co. 121
★Atlas Copco AB, Sweden .. 1
★Atlas Powder Co. 76

★Babcock & Wilcox Co. 12
Barrett, Haentjens & Co. .. 98
Bemis Bro. Bag Co. 108
★Bethlehem Pacific Coast Steel Corp. 14
Black & Deasan 128
★Boyles Bros. Drilling Co. .. 114
★Boyles Bros. Drilling Co., Ltd. 19
★Brown, David 107
★Brunner & Lay, Inc. 95
★Bucyrus-Erie Co. 32
★Bunker Hill Co. 106
Business Men's Clearing House 131

★Card Iron Works, C. S. 127
Caterpillar Tractor Co. 4, 42, 82
Chapman & Wood 128
★Clark Equipment Co. 84-85
★Clark Equipment International, C. A. ..... WM8 (World Mining Only)
★Coast Mfg. Co. 114
Colorado Assaying Co. 128
★Colorado Fuel & Iron Corp. 26
★Colorado Iron Works, sub. of Mine & Smelter Supply Co. 123
★Columbian Steel Tank Co. . 110
Cowin & Co., Inc. 128

Darien Corp. 129
Deggendorfer, T. G. 128
★Deister Concentrator Co., Inc. 121
★Denver Equipment Co. 48
Diamond Drill Contracting Co. 129
Dickinson Laboratories, Inc. 128
★Differential Steel Car Co. .. 111
★Dorr-Oliver, Inc. 21
★Dow Chemical Intl Ltd. .. WM24 (World Mining Only)

★Eimco Corp. ..... WM21 Outside Front Cover (World Mining Only)
★Electric Storage Battery Co. 22
Elliott, D. H. 128
★Equipment Engineers, Inc. . 24

★Euclid Div., General Motors Corp. 33
★Euclid Div., General Motors Overseas Operations .. WM15 (World Mining Only)

Federal Pipe & Tank Co. .. 131
Flexible Steel Lacing Co. .. 125

Gardner-Denver Co. 40
Gates Rubber Co. 2
★General Motors Corp., Euclid Div. 33
★General Motors Overseas Operations, Euclid Div. WM15 (World Mining Only)
★Godoy & Co., Inc., E. A. . 121
Goodall Brothers 128
★Goodman Mfg. Co. .... WM28 (World Mining Only)
Goodyear International Corp. ..... WM5 (World Mining Only)
★Gould & Co., Gordon I. .. 110
★Greensburg Machine Co. .. 125

Hanks, Inc., Abbot A. 128
★Hardinge Co. 104
★Harnischfeger Corp. 44-45
★Harnischfeger Export Corp. ..... WM19 (World Mining Only)
Hawley & Hawley 128
★Hewitt-Robins 105
★Humphreys Investment Co.. 34

Industrial Physics and Electronics Co. 108
★Ingersoll-Rand Co. 46
★International Smelting & Refining Co. 106
Isbell Construction Co. 108

Jaeger Machine Co. 87
Johnson, Herbert B. 128
Johnson March Co. 103
Jones, Philip L. 128
★Joy Mfg. Co. 36

Koegel, C. P. 128
★Kennametal, Inc. 113
★Kenworth Motor Truck Corp. 39
Kirk Co., Wallace E... 129, 130

★Ledoux Mfg. Co. 102
Ledoux & Co. 128
★LeTourneau-Westinghouse Co. 23, 25, 27
★Link-Belt Co. ..... WM22 (World Mining Only)
Livingston & Wilson Exploration Drilling Co. 129
★Longyear Co., E. J. ..... 124 Inside Back Cover

★Mace Co. 122
Machinery Center, Inc. 130
Macro Tungsten Refinery .. 132
★Magma Copper Co. 106
★Marion Power Shovel Co. ..
McDowell Co., Inc. 8
McGriffin, Ken 128
★Meissner Engineers, Inc., John F. 124
★Merrick Scale Mfg. Co. 11
★Mine Safety Appliances Co. 83
★Mine & Smelter Supply Co. 28, 123
Moab Drilling Co. 128
Morse Bros. Machinery Co.. 131

★National Malleable & Steel Castings Co. 96
★National Tank & Pipe Co.. 129
Nichols & Thompson Core Drilling Co., Inc. 110
★Nordberg Mfg. Co. 16-17

O'Donnell & Schmidt 124
O'Keeffe, John J. 128
Oil Tool Mfg. Co. 119
★Ore & Chemical Corp. 93

★Pacific Foundry Co., Ltd. . .122
Perry Equipment Corp. 130
Piggott Projects 128

Quaker Rubber Div., H. K. Porter Company, Inc. 101

★Riblet Tramway Co. 47

Sanford Day Iron Works .. 88
★Santa Fe Tank & Tower Div., Fluor Corp. 94
★Sauerman Bros., Inc. 100
★Schaffer Poidometer Co. 120
★Sheffield Steel Corp. ..... WM6 (World Mining Only)
Sherman, Howard P. 128
★Simplex Wire & Cable Co. .. 41
★Skookum Co., Inc. 110
Smerchanski, Mark G. 124
★Smidth & Co., F. L. 15
★Smit & Co., Inc., Anton .. 112
Smith-Emery Co. 128
Smith, Paul F. 130
Southern Mill & Mfg. Co. .. 94
Southern Spectrographic Lab. 128
★Sprague & Henwood, Inc. . 97
★Standard Oil Co. of Calif.. 38
★Standard Steel Corp. 81
Still & Still 128
★Steody Co. 6
★Syntron Co. 109

Tate Mine Contracting & Development Co. 128
★Thew Shovel Co. 116
★Timken Roller Bearing Co. . 89
★Traylor Eng. & Mfg. Co. .. 92
Turner & Associates 128

★Union Oil Co. 86
U. S. Borax & Chemical Corp. 129
★U. S. Steel Corp. 78-79

Wade, William Rogers 129
Wah Chang Mining Corp. . 128
Warn Mfg. Co. 94
Wedge Wire Corp. 126
Western Engineering Co. .. 131
★Western Machinery Co., Inside Front Cover
★Western Precipitation Corp. 90
★Western Rock Bit Mfg. Co.. 114
★White Diesel Engine Div., White Motor Co. 35
★Wickwire Spencer Div., Colorado Fuel & Iron Corp. 26
★Wild Heerbrugg Instruments, Inc. 99
★Willey & Sons, Inc., A. R. Outside Back Cover
Wilson Exploration Co. 128
Wilson, Glenn B. 131
Winston Steel Works 124
Wisser & Cox 128
Wolf, Harry J. 128
Wood, Kenneth 130
Wood Assaying Co., Henry E. 128

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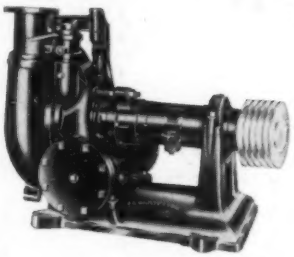

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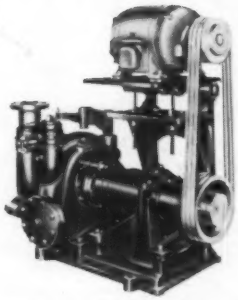

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